Medicine Lodge Subbasin Assessment and TMDLs

February 18, 2003

Medicine Lodge Subbasin Assessment and TMDLs

February 18, 2003

Prepared by:
Kathleen McKinley, University of Idaho
Dinah Reaney, State Office of Technical Services
Idaho Department of Environmental Quality
900 N. Skyline Suite B
Idaho Falls, ID 83402

Acknowledgments

Many individuals assisted in preparing this report by providing important information and critical review of earlier drafts, making a more complete and accurate document than would otherwise have been possible. Thanks are due to the entire water quality group in the Idaho Falls Regional office, including Steve Robinson, Troy Saffle, Sheryl Hill, Melissa Thompson, and Tom Herron, for their help in putting the document together. Steve Robinson also contributed immensely in the collection of field data. Mark Shumar was a contributing author and reviewer, and Don Zaroban and Bill Clark, all of the DEQ central office also provided valuable aid in putting the document together. BLM's Dan Kotansky and Pat Koelsch provided water quality data, PFC information and fisheries information. Eliot Traher, with the Idaho Association of Soil Conservation Districts, provided streambank erosion inventory data that he collected and analyzed in the subbasin which became the basis for the TMDL. Elliot also provided critical review of the draft document and aided in manipulating GIS covers. Mike Philbin, Rob Mickelson and Jim Capurso with the USFS provided water quality, fisheries, and range management data for the subbasin. Idaho Fish and Game's Mark Gamblin provided fisheries data. Dave Hoover with the NRCS central office provided all of the information for the soil section. Loyd Bradshaw, Cleve Bagely, and Robert Lehman, of the NRCS Rexburg office provided information and data on water quality improvement projects that have taken place over the years. The Teton Regional Land Trust also provided information on work they have done to improve land in Medicine Lodge.

Table of Contents

List of Tables

List of Figures

List of Appendices

Abbreviations, Acronyms, and Symbols

303(d) Refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section

µ micro, one-one thousandth

§ Section (usually a section of federal or state rules or statutes)

ADB assessment database

AWS agricultural water supply

BAG Basin Advisory Group

BLM United States Bureau of Land Management

BMP best management practice

BOD biochemical oxygen demand

BOR United States Bureau of Reclamation

Btu British thermal unit

BURP Beneficial Use Reconnaissance Program

C Celsius

CFR Code of Federal Regulations (refers to citations in the federal administrative rules)

cfs cubic feet per second

cm centimeters

CW cold water

CWA Clean Water Act

CWE cumulative watershed effects

DEQ Idaho Department of Environmental Quality

DO dissolved oxygen

DOI U.S. Department of the Interior

DWS domestic water supply

EMAP Environmental Monitoring and Assessment Program

EPA United States Environmental Protection Agency

ESA Endangered Species Act

F Fahrenheit

FPA Idaho Forest Practices Act

FWS U.S. Fish and Wildlife Service

GIS Geographical Information Systems

HUC Hydrologic Unit Code

I.C. Idaho Code

IDAPA Refers to citations of Idaho administrative rules

IDFG Idaho Department of Fish and Game

IDL Idaho Department of Lands

IDWR	Idaho Department of Water Resources
INFISH	The federal Inland Native Fish Strategy
IRIS	Integrated Risk Information System
km	kilometer
km^2	square kilometer
LA	load allocation
LC	load capacity
m	meter
m^3	cubic meter
mi	mile
mi^2	square miles
MBI	macroinvertebrate biotic index
MGD	million gallons per day
mg/l	milligrams per liter
mm	millimeter
MOS	margin of safety
MWMT	maximum weekly maximum temperature
n.a.	not applicable
NA	not assessed
NB	natural background
nd	no data (data not available)
NFS	not fully supporting
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NTU	nephlometric turbidity unit
ORV	off-road vehicle
ORW	Outstanding Resource Water
PACFISH	The federal Pacific Anadromous Fish Strategy
PFC	proper functioning condition
PCR	primary contact recreation
ppm	part(s) per million
QA	quality assurance
QC	quality control
RBP	rapid bioassessment protocol
RDI	DEQ's river diatom index
RFI	DEQ's river fish index
RHCA	riparian habitat conservation area
RMI	DEQ's river macroinvertebrate index
RPI	DEQ's river physiochemical index
SBA	subbasin assessment
SCR	secondary contact recreation
SFI	DEQ's stream fish index
SHI	DEQ's stream habitat index

SMI DEQ's stream macroinvertebrate index

SRP soluble reactive phosphorus

SS salmonid spawning

SSOC stream segment of concern

STATSGO State Soil Geographic Database

TDG total dissolved gas

TDS total dissolved solids

T&E threatened and/or endangered species

TIN total inorganic nitrogen

TKN total Kjeldahl nitrogen

TMDL total maximum daily load

TP total phosphorus

TS total solids

TSS total suspended solids

t/y tons per year

U.S. United States

USC United States Code

USDA United States Department of Agriculture

USDI United States Department of the Interior

USFS United States Forest Service

USGS United States Geological Survey

WAG Watershed Advisory Group

WBAG *Water Body Assessment Guidance*

WBID water body identification number

WET whole effluence toxicity

WLA waste load allocation

WQLS water quality limited segment

WQMP water quality management plan

WQRP water quality restoration plan

WQS water quality standard

Executive Summary

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters (33 USC § 1251.101). States and tribes, pursuant to section 303 of the CWA are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list of impaired waters, currently every two years. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses the water bodies in the Medicine Lodge Subbasin that have been placed on what is known as the "303(d) list."

This subbasin assessment and TMDL analysis has been developed to comply with Idaho's TMDL schedule. This assessment describes the physical, biological, and cultural setting; water quality status; pollutant sources; and recent pollution control actions in the Medicine Lodge Subbasin located in southeastern Idaho. The first part of this document, the subbasin assessment, is an important first step in leading to the TMDL. The starting point for this assessment was Idaho's current 303(d) list of water quality limited water bodies. Five segments of the Medicine Lodge Subbasin were listed on this list. The subbasin assessment portion of this document examines the current status of 303(d) listed waters, and defines the extent of impairment and causes of water quality limitation throughout the subbasin. The loading analysis quantifies pollutant sources and allocates responsibility for load reductions needed to return listed waters to a condition of meeting water quality standards.

Subbasin at a Glance

The Medicine Lodge Watershed is located in southeastern Idaho and is approximately 872 square miles in size bordering Montana to the north. The northern half of the hydrologic unit code (HUC) is rurally occupied with about one person for every two acres. The southern half of the HUC has a higher population, but does not contain any of the flowing streams of Medicine Lodge or its tributaries. Medicine Lodge sinks and is diverted very soon after the town of Small, Idaho. Crooked Creek, Warm Springs Creek, and Deep Creek are not tributaries of Medicine Lodge Creek, but flow independently in drainages to the west of Medicine Lodge. These streams also sink before reaching another water body.

Three species of salmonids have been documented in the watershed. Rainbow trout, brook trout and Yellowstone cutthroat trout are all found throughout Medicine Lodge Creek and its tributaries. The Yellowstone cutthroat trout is considered a state sensitive species and is carefully managed by the Idaho Department of Fish and Game (IDFG). Warm Springs Creek contains some warm water species of fish.

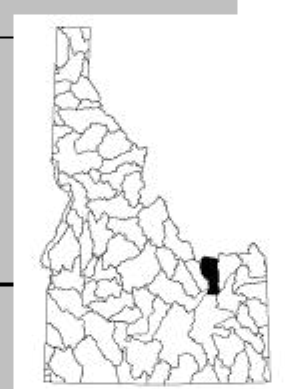
Medicine Lodge Creek's designated beneficial uses include salmonid spawning, coldwater biota, primary contact recreation, domestic water supply and special resource water. Edie Creek, Irving Creek and Fritz Creek are all protected for cold water, salmonid spawning and secondary contact recreation. Warm Springs Creek does not have any designated beneficial uses. Assessments by the Idaho Department of Environmental Quality (DEQ) have identified that water quality is limited on five of the streams in the subbasin.

The DEQ has collected data throughout the subbasin and it has been determined that sediment and temperature are the primary pollutant of concern. TMDLS for sediment have been developed for Medicine Lodge Creek, Fritz Creek, and Irving Creek. Sediment load reductions are quantified through streambank erosion inventories that estimate erosion based on streambank conditions documented along the private land of the 1998 303(d) listed streams. Instream sediment targets have been identified from literature values that are supportive of salmonid spawning and cold water aquatic life. These target values will be used to track the progress of streambank recovery and determine the need for additional management practices to improve water quality.

Temperature TMDLs have been developed for all streams where thermograph data has been collected to support salmonid spawning and CWAL within those streams. Salmonid spawning has been determined an existing use for streams within the Medicine Lodge Subbasin, except for Warm Springs Creek, Divide Creek, Deep Creek, and the lower portion of Medicine Lodge Creek, due to the presence of cold water fisheries.

Nutrient TMDLs will not be written for the streams in the Medicine Lodge Subbasin since there is no observational or collected data indicating nutrient enrichment in any part of the watershed.

Medicine Lodge Creek Subbasin at a Glance:		
Hydrologic Unit Code	17040215	
1998 Water Quality Limited Segments	Edie Creek Fritz Creek Warm Springs Creek	Irving Creek Medicine Lodge Creek
Beneficial Uses Affected	Cold Water Aquatic life Salmonid Spawning Primary Contact Recreation Secondary Contact Recreation Domestic Water Supply Special Resource Water	
Pollutants of Concern	Sediment, Temperature, Nutrients, Flow Alteration Habitat Alteration	
Major Land Uses	Grazing, Irrigated Agriculture, Dryland Farming	
Area	872 mi²	
Population (1999 Clark County)	913	



Key Findings

- The Medicine Lodge Subbasin has no known point sources of pollution within its boundaries. Sources of non-point source pollution consist of land disturbance from grazing, unmaintained roads, farming, recreation, diversions, and river adjustments after a large flooding event in 1995. The primary water quality concern within the Medicine Lodge Subbasin is related to subsurface fine sediment deposited within the stream substrate, which is likely impacting the abundance and quality of fish habitat. The primary source of sediment appears to be streambank erosion. The primary cause of streambank erosion is related to the downcutting of the stream channel and the subsequent sloughing of streambanks.

- Streambank erosion in Medicine Lodge is primarily occurring due to animal access. The majority of the watershed is used for rangeland, with few sections of riparian buffer fenced for protection. Other sources of streambank erosion are the road crossings, poor irrigation diversion gates and other upsets to the hydrologic regime. Many areas of the Medicine Lodge watershed are re-establishing a flood plain. This process will likely take many years and will result in much additional streambank erosion. Riparian vegetation will likely re-establish on outside bends in which it is absent as the re-stabilization process takes place. Additionally, as riparian conditions improve over the listed reaches in the Medicine Lodge Subbasin, the added benefit of reduced thermal loading will likely be realized and the temperature regime in these streams will likely improve. The Idaho Association of Soil Conservation Districts has also been awarded a grant to replace several of the dysfunctional diversion gates in the subbasin, which will decrease the impact they have on the area.

- The majority of the roads along Medicine Lodge Creek are paved with bridges over stream crossings that are maintained by the county. However, there are several portions of the stream, which are severely encroached by the road causing a disturbance of the natural hydrology which can cause excessive sedimentation downstream. The road up Edie Creek is a dirt road, with six undeveloped road crossings on the BLM land in the upper portions of the creek while Irving Creek has no undeveloped road crossings. These road crossings on Edie Creek and the streambank instability caused by animal access on both streams are the main sources of excess sediment.

- A numerical target has been set for sediment throughout the subbasin. The goal of the sediment TMDLs developed in Medicine Lodge is to improve the quality of spawning and incubation of substrate and rearing habitat for trout. The subsurface fine sediment target is less than or equal to 28% fine particles <6.35 (0.25 in) sediment, not including substrate larger than 63.5mm (2.5 in), in potential or known salmonid spawning habitat. This percentage has been adapted by the DEQ to be capable of supporting salmonid spawning as well as improve other aspects of salmonid spawning habitat. The strategy used to achieve this sediment target is to reduce streambank erosion, which is believed to be the main cause of excessive sedimentation into the watershed.

- The sediment load that can be assimilated by the streams in Medicine Lodge and still meet the State's water quality narrative sediment criteria is unknown. The beneficial use of salmonid spawning is impacted by sediment loading above the assimilative capacity of the creek. The loading capacity lies somewhere between the current loading level and the sediment loading from natural streambank erosion levels. Cold water aquatic life and salmonid spawning are naturally occurring beneficial uses in Medicine Lodge Creek and its tributaries. We therefore assume that cold water aquatic life and salmonid spawning would be fully supported at natural background sediment loading rates. We also assume that natural streambank stability was equal to or greater than 80% (Overton et al. 1995).

Because the primary chronic source of sediment loading to Edie Creek, Irving Creek and Medicine Lodge Creek is streambank erosion, quantitative allocations are developed. These sediment load reductions are designed to meet the established instream water quality target of 28% or less fine sediment <6.35 mm in areas suitable for salmonid spawning. Streambank erosion reductions are quantitatively linked to tons of sediment per year. An inferential link is identified to show how sediment load allocations will reduce subsurface fine sediment to or below target levels. This link assumes that by reducing chronic sources of sediment, there will be a decrease in subsurface fine sediment that will ultimately improve the status of beneficial uses. Streambank erosion load allocation is based upon the assumption that natural background sediment production from streambanks equates to 80% streambank stability as described in Overton and others (1995), where stable banks are expressed as a percentage of the total estimated bank length. Natural condition streambank stability potential is generally 80% or greater for A, B, and C channel types in plutonic, volcanic, metamorphic and sedimentary geology types.

Based on the streambank erosion inventory of Edie Creek, the estimated total existing sediment load from streambank erosion for the segment on private land is 58.2 tons/mile/year. The estimated sediment load from streambanks that are 80% stable is 36.7 tons/mile/year. A sediment load reduction of 21.5 tons/mile/year is anticipated if 80% or greater streambank stability is achieved. Irving Creek's streambank erosion inventory estimated that the total existing sediment load from streambanks on private land is 251.5 tons/mile/year. The estimated sediment load from streambanks that are 80% stable is 89.6 tons/mile/year. A sediment load reduction of 161.9 tons/mile/year is anticipated if 80% or greater streambank stability is achieved. Based on the streambank erosion inventory of Medicine Lodge Creek, the estimated total existing sediment load from streambank erosion for private land is 83.3 tons/mile/year. The estimated sediment load from streambanks that are 80% stable is 46.0 tons/mile/year. A sediment load reduction of 37.3 tons/mile/year is anticipated if 80% or greater streambank stability is achieved.

It is anticipated that by reducing the chronic sediment load through increased streambank stability, the instream target of 28% subsurface fines will be achieved. If the instream target is attained, the beneficial use of natural spawning by salmonids should eventually be restored to full support. Streambank stability, the percentage of subsurface fines in salmonid spawning habitat and age class structure of salmonids must be monitored every other year to determine the effectiveness of land management activities and of this TMDL.

- The margin of safety (MOS) is factored into load allocations for sediment for Edie Creek, Irving Creek, and Medicine Lodge Creek. The MOS is the conservative assumptions used to develop existing sediment loads, where background conditions are more than needed to attain full support of uses are employed. Conservative assumptions made as part of the sediment loading analysis include: 1) Desired bank erosion rates are representative of background conditions of 80 %, as described in Overton and others ; 2) Water quality targets for percent depth fines of less than 28% (<6.35mm), are consistent with values measured and set by local land management agencies based on established literature values and incorporate a more than adequate level of fry survival to provide for stable salmonid production. It is assumed that the status of beneficial uses will be improved prior to the attainment of the targets of 80 % erosion rates and less than 28% depth fines in this TMDL.

- Streambank erosion is also the cause for increased temperatures throughout the Medicine Lodge Subbasin. Collected thermograph data establishes that Temperature TMDLs are necessary to meet salmonid spawning temperature criteria on all streams except Deep Creek, since there are no fish documented in this stream. Temperature TMDL load reductions were developed by quantifying daily temperature exceedances during spring and fall spawning seasons and dividing the maximum temperature exceeedance collected by the salmonid spawning criteria to get a percent reduction in temperature. Of all streams sampled throughout the subbasin, Deep Creek was the only stream not needing a salmonid spawning temperature TMDL because no fish data exists for this stream. All other streams document the presence of cold water fisheries, therefore Salmonid Spawning is an existing beneficial use.

- Salmonid Spawning temperature targets developed for the Medicine Lodge Subbasin are based on existing numeric criteria of [IDAPA 58.01.02.250(02)].

- The MOS factored into load allocations for water temperature is based on the maximum observed temperature exceedances for each critical time period. Maximum exceedances of the most restrictive criteria were used to identify needed temperature reductions based upon the assumption that if temperature reductions are directed at eliminating the recorded maximum exceedance of criteria, then lesser exceedances will be eliminated during other times of the year.

- The development of an implementation plan for Medicine Lodge Creek Subbasin is currently underway and the draft plan is found in Appendix F. The implementation plan identifies Best Management Practices (BMPs) that will be implemented on streams with TMDLs throughout the subbasin to improve riparian condition and stream channel habitat and reduce streambank erosion. BMPs that will be implemented within the subbasin focus on agricultural irrigation diversions, irrigation efficiency, and prescribed livestock grazing protection.

- The information presented in this subbasin assessment indicated that the development of a total maximum daily load (TMDL) is unnecessary for Warm Springs Creek. Warm Springs Creek is on the 1998 303(d) list for nutrients and sediment and has no designated beneficial uses. Thermograph data collected on the stream (Figure 44) indicates that the stream is naturally thermal. Only warm water species of fish have been found in the creek, and it is therefore recommended that the stream be designated for warm water aquatic life or seasonal cold water aquatic life.

- It is recommended that TMDLs for nutrients not be written for any of the streams in the watershed. There is no data that indicates excessive slime growth, and there is no observational data present indicating excessive slime growth in any part of the watershed indicating that the listing was in error. Several meetings with the Watershed Advisory Group (WAG) have taken place for the Medicine Lodge Subbasin. These have primarily been informative meetings, keeping the group involved in the pace of TMDL development and allowing time for concerns of the group to be addressed. A minimum of a 30-day public comment period and an additional WAG meeting will take place prior to EPA submittal.

- Although there is a large amount of water quality data for Medicine Lodge, it would be helpful to conduct more electrofishing on Crooked Creek. The USFS found 19 Yellowstone cutthroat trout in the creek in 1997, but did not measure the fish. We do not know how many age classes are present, and therefore cannot assess the health of the population. The DEQ also electrofished Crooked Creek in 1997 and again in 2000, but did not collect any fish.

- Additional streambank erosion inventories should also be conducted on all listed streams. The Soil Conservation Commission conducted a wealth of streambank assessment information including streambank erosion inventories for four of the streams on the 1998 303(d) list. These inventories only included private land, however, and complimentary information should be collected for the upper reaches of these streams.

Table A. Summary of assessment outcomes for which TMDLs were developed.

Water Body Segment	Assessment Units of ID17040215	Pollutant	TMDL(s) Developed	Recommended Changes to 303(d) List	Justification
Crooked Creek Headwaters to sinks	SK021_02 SK021_03	**Temperature**	Yes	Add	Temperature exceedances documented
Deep Creek Headwaters to sinks	SK018_02 SK018_03	**Temperature**	Yes	Add	Temperature exceedances documented
Edie Creek WQLS 2210 Headwaters to ML Creek	SKO10_02	Habitat Alteration	No	None	DEQ Policy
		Nutrients	No	Delist	No excess algal growth documented
		Temperature	Yes	Add	Temperature exceedances documented
		Sediment	Yes	None	

Water Body Segment	Assessment Units of ID17040215	Pollutant	TMDL(s) Developed	Recommended Changes to 303(d) List	Justification
Fritz Creek WQLS 2212 Forks to ML Creek	SK016_02	Nutrients	No	Delist	No excess algal growth documented
		Temperature	Yes	None	Temperature exceedances documented
Horse Creek Headwaters to mouth	SK015_02	**Temperature**	Yes	None	Temperature exceedances documented
Indian Creek Headwaters to Medicine Lodge Creek	SK003_02 SK003_03	**Temperature**	Yes	Add	Temperature exceedances documented
Irving Creek WQLS 2211 Headwaters to ML Creek	SK012_02 SK012_03	Habitat Alteration	No	None	DEQ Policy
		Nutrients	No	Delist	No excess algal growth documented
		Temperature	Yes	Add	Temperature exceedances documented
		Sediment	Yes	None	
Medicine Lodge Creek WQLS 2215 Spring Creek Hollow to Small, ID	SK0006_04	Flow Alteration	No	None	DEQ Policy
		Sediment	Yes	None	
		Temperature	Yes	None	Temperature exceedances documented
Middle Creek Headwaters to Medicine Lodge Creek	SK008_02 SK007-02 SK007_03	**Temperature**	Yes	Add	Temperature exceedances documented
Warm Creek Headwaters to Confluence	SK013_02 SK013_03	**Temperature**	Yes	Add	Temperature exceedances documented
Warm Springs Creek Headwaters to Sinks	SK020_02 SK020_03	Nutrients	No	Delist	No excess algal growth documented
		Sediment	No	Delist	Thermal spring so no violations of CWAL or SS, and depth fines already meeting target of 28%

Water Body Segment	Assessment Units of ID17040215	Pollutant	TMDL(s) Developed	Recommended Changes to 303(d) List	Justification
Webber Creek Headwaters to Medicine Lodge Creek	SK017_02	**Temperature**	Yes	Add	Temperature exceedances documented

Streams shown in bold are streams and pollutants for which a TMDL was developed.

1. Subbasin Assessment – Watershed Characterization

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters (33 USC § 1251.101). States and tribes, pursuant to section 303 of the CWA are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list of impaired waters, currently every two years. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses the water bodies in the Medicine Lodge Subbasin that have been placed on what is known as the "303(d) list."

The overall purpose of this subbasin assessment and TMDL is to characterize and document pollutant loads within the Medicine Lodge Subbasin. The first portion of this document, the subbasin assessment, is partitioned into four major sections: watershed characterization, water quality concerns and status, pollutant source inventory, and a summary of past and present pollution control efforts (Chapters 1 – 4). This information will then be used to develop a TMDL for each pollutant of concern for the Medicine Lodge Subbasin (Chapter 5).

1.1 Introduction

In 1972, Congress passed public law 92-500, the Federal Water Pollution Control Act, more commonly called the Clean Water Act. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Water Pollution Control Federation 1987). The act and the programs it has generated have changed over the years as experience and perceptions of water quality have changed. The CWA has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to insure "swimmable and fishable" conditions. This goal, along with a 1972 goal to restore and maintain chemical, physical, and biological integrity, relates water quality with more than just chemistry.

Background

The federal government, through the U.S. Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the county. The Idaho Department of Environmental Quality (DEQ) implements the CWA in Idaho, while the EPA oversees Idaho and certifies the fulfillment of CWA requirements and responsibilities.

Section 303 of the CWA requires DEQ to adopt, with EPA approval, water quality standards and to review those standards every three years. Additionally, DEQ must monitor waters to identify those not meeting water quality standards. For those waters not meeting standards, DEQ must establish TMDLs for each pollutant impairing the waters. Further, the agency must set appropriate controls to restore water quality and allow the water bodies to meet their designated uses. These requirements result in a list of impaired waters, called the "303(d) list." This list describes water bodies not meeting water quality standards. Waters identified on this list require further analysis. A subbasin assessment and TMDL provide a summary of the water quality status and allowable TMDL for water bodies on the 303(d) list. The *Medicine Lodge Subbasin Assessment and TMDL* provides this summary for the currently listed waters in the Medicine Lodge Subbasin.

The subbasin assessment section of this report (Chapters 1 – 4) includes an evaluation and summary of the current water quality status, pollutant sources, and control actions in the Medicine Lodge Subbasin to date. While this assessment is not a requirement of the TMDL, DEQ performs the assessment to ensure impairment listings are up to date and accurate. The TMDL is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR § 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also includes individual pollutant allocations among various sources discharging the pollutant. The EPA considers certain unnatural conditions, such as flow alteration, a lack of flow, or habitat alteration, that are not the result of the discharge of specific pollutants as "pollution." TMDLs are not required for water bodies impaired by pollution, but not specific pollutants. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

Idaho's Role

Idaho adopts water quality standards to protect public health and welfare, enhance the quality of water, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

The state may assign or designate beneficial uses for particular Idaho water bodies to support. These beneficial uses are identified in the Idaho water quality standards and include:

- Aquatic life support – cold water, seasonal cold water, warm water, salmonid spawning, modified

- Contact recreation – primary (swimming), secondary (boating)

- Water supply – domestic, agricultural, industrial

- Wildlife habitats, aesthetics

The Idaho legislature designates uses for water bodies. Industrial water supply, wildlife habitat, and aesthetics are designated beneficial uses for all water bodies in the state. If a water body is unclassified, then cold water and primary contact recreation are used as additional default designated uses when water bodies are assessed.

A subbasin assessment entails analyzing and integrating multiple types of water body data, such as biological, physical/chemical, and landscape data to address several objectives:

- Determine the degree of designated beneficial use support of the water body (i.e., attaining or not attaining water quality standards).

- Determine the degree of achievement of biological integrity.

- Compile descriptive information about the water body, particularly the identity and location of pollutant sources.

- When water bodies are not attaining water quality standards, determine the causes and extent of the impairment.

1.2 Physical and Biological Characteristics

The Medicine Lodge subbasin is located in Idaho on the northeastern margin of the Snake River plain. Approximately 37 miles of the continental divide, which also marks the state boundary between Idaho and Montana, define the north perimeter of the drainage. The elevation along this portion of the continental divide ranges from 7,500 ft above sea level near Divide Creek, the northern most creek in the drainage, to 10,105 ft at the Red Conglomerate Peaks. The Hydrologic Unit Code (HUC) is rectangular with a width of approximately 7 miles across at the top and narrowing down to less than 4 miles across in the lower half and widening again at the very bottom to approximately 5 mi. The length of the drainage is about 15.3 mi.

The Beaverhead Mountain Range comprises the north portion of the watershed. The various peaks throughout the watershed are shown in Figure 2. The highest peak in the watershed is Scott Peak at 11,394 feet, which is located on the western edge of the subbasin at the headwaters of Webber Creek. Webber Peak (11,180 ft) is just to the south of Scott Peak. Heart Mountain (10,423 ft) and the Red Conglomerate Peaks (10,105 ft) are the other elevation points that are above 10,000 ft in the drainage.

The main stem of Medicine Lodge Creek begins at the northwestern corner and flows in a southeasterly direction until it reaches the eastern border of the HUC about halfway down the HUC at Small, ID. The elevation of Medicine Lodge Creek begins at about 6,500 ft above sea level at the confluence of Fritz Creek and Warm Creek. It lowers to an elevation of 6,132 ft at the confluence with Spring Hollow and continues to Small, ID where the elevation is 5,260 ft. The length of the stretch from the beginning of Medicine Lodge Creek to Small, ID is approximately 21.24 stream miles, giving an approximate average valley gradient of 41 ft/mi. Figure 1 displays the location of the Medicine Lodge watershed.

Figure 1. Medicine Lodge Watershed

Climate

The closest weather reporting station for the Medicine Lodge Drainage is found in Dubois, Idaho, approximately 7.5 miles southeast of Small, ID. The period of record for this discussion is from 1/1/1925 to 4/30/2000. The area is characterized as a semi-arid steppe that ranges in elevation from 5,281 ft above sea level at Small, ID to about 6,500 ft above sea level at the confluence of Fritz Creek and Warm Creek where they join to create Medicine Lodge Creek. Because the elevation of the weather recording station at Dubois is 5,460 ft above sea level, it represents a mid-elevation band (WRCC 2000).

According to long-term records from the Western Regional Climate Center weather station in Dubois, average monthly temperatures range from 18.5?F in

January to 68.6?F in July. The average maximum temperature for July is 73.3?F with a daily extreme of 102?F recorded on July 23, 1931. The average minimum temperature is 10.2?F in January, while the minimum daily extreme of -31?F was recorded on December 22, 1990. Table 1 includes average monthly temperatures (WRCC 2000). Figure 3 and 4 displays the mean monthly temperatures and mean monthly precipitation patterns.

The majority of the precipitation in the drainage occurs as snowfall. The average total snowfall for January is 10.6 in and for December it is 11.8 in. The majority of rainfall occurs in May and June when the mean is 1.69 in and 1.80 in, respectively. The annual mean amount of precipitation is 12.03 in and the annual mean amount of snowfall is 47.9 in. According to the monthly total precipitation by year at the Dubois Experiment Station, the highest recorded year of precipitation occurred in 1995 with an annual amount of 21.34 in. Table 1 includes the average monthly precipitation (WRCC 2000). Figure 5 displays annual precipitation for 1995.

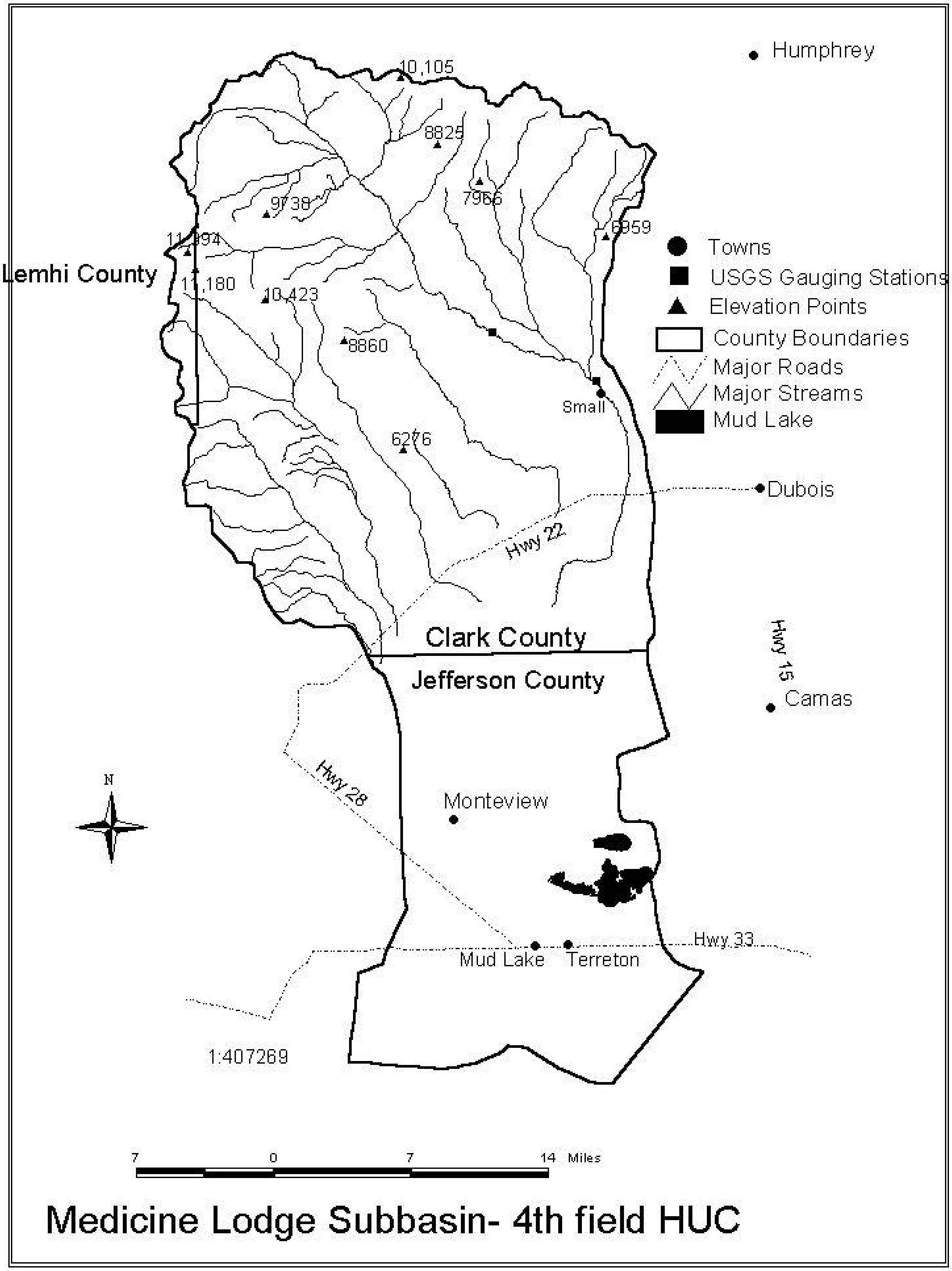


Figure 2. Medicine Lodge Watershed

Table 1. Summary of climate data collected from January 1, 1925 to April 30, 2000 at Dubois, Idaho

Period	Average Max Temp (F)	Average Min Temp (F)	Average Mean Temp (F)	Highest Average Temp (F)	Lowest Average Temp (F)	Average Total Snowfall (in)	Average Total Precipitation (in)
January	27.0	10.2	18.5	30.7	3.0	10.6	0.77
February	32.0	14.1	23.0	34.2	9.6	9.0	0.74
March	39.9	20.4	30.2	44.8	20.0	5.6	0.76
April	54.4	29.8	42.1	52.2	31.4	2.1	0.96
May	65.3	38.3	51.8	60.8	46.2	0.9	1.69
June	74.1	44.9	59.5	66.4	53.5	0.1	1.80
July	85.1	52.1	68.6	73.3	58.0	0.0	0.86
August	83.6	50.4	67.0	72.1	61.0	0.0	0.94
September	72.6	42.1	57.3	63.8	49.2	0.1	0.90
October	58.4	32.8	45.6	54.1	37.3	1.3	0.82
November	39.8	21.7	30.7	39.4	20.7	6.3	0.90
December	29.6	13.1	21.4	28.6	10.1	11.8	0.89
Annual	55.2	30.8	43.0	48.9	38.5	47.9	12.03

Source: Western Regional Climate Center @ http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?iddubo

Subbasin Characteristics

Hydrography/Hydrology

Medicine Lodge Creek, the largest creek in the drainage, flows approximately 21.24 stream miles in a southeasterly direction. Medicine Lodge Creek begins at the confluence of Warm Creek and Fritz Creek and flows through a mixed geology of loess and basalt.

The Medicine Lodge watershed is a closed system. The tributaries that reach Medicine Lodge Creek contribute to the flow, but some do not reach it year round due to infiltration and diversions. Medicine Lodge Creek does not continue far past Small, ID due to loss through the soil and diversion for agriculture. There are also sub-watersheds to the west of Medicine Lodge that never reach the main stream, but are still contained in the 4th field hydrologic unit code. The 4th field HUC is a watershed classification system designed by the USGS separating areas by watershed boundaries. The 4th field HUCs may be further specified into 5th and 6th field HUCs as they get progressively smaller in area. Crooked Creek, Warm Springs Creek and Deep Creek all parallel Medicine Lodge Creek in sub-watersheds to the west. These creeks all sink before they reach another water body.

The streams in the drainage are composed of two main types. The majority of streams flow due to runoff from rainfall and snowmelt from the surrounding mountains and while Warm Springs Creek and Warm Springs are both from natural thermal springs. (BLM 2001)

Current hydrologic conditions differ from historic conditions.

> "Based on historical accounts and personal communications, many of the tributary streams to Medicine Lodge Creek long ago had extensive beaver dam complexes and ponds that provided abundant fishing opportunities. Today the hydrologic regime is altered with these streams experiencing downcutting and gullying, with a lower water table stressing and reducing remnant riparian-wetland vegetation. Beaver removal, dredging and draining of wetlands, irrigation withdrawals, improper grazing and natural, high flow events have all contributed to the present condition. This present condition of the stream channel compared to the earlier prevalence of beaver-dominated systems, is still affecting the hydrologic regime and sediment delivery." (BLM 2001)

The United States Geological Survey (USGS) has had two gauging stations in the Medicine Lodge Drainage. Table 2 lists the gauging stations and Figure 2 shows their locations. Station number 13116000 was located at the Ellis Ranch on Medicine Lodge Creek above the confluence of Middle Creek while station number 13116500 was located near Small, ID. Neither station is currently active.

Table 2. USGS Gauging Station

Station Number	Station Name	Drainage Area (mi^2)	Elevation ft above National Geodetic Vertical Datum or (NGVD)	Period of record
13116000	Medicine Lodge Creek at Ellis Ranch	165 mi^2	5710	1940-1969
13116500	Medicine Lodge Creek at Small, ID	270 mi^2	5480	1921-23, 1941-49, 1985-96, 1997-99

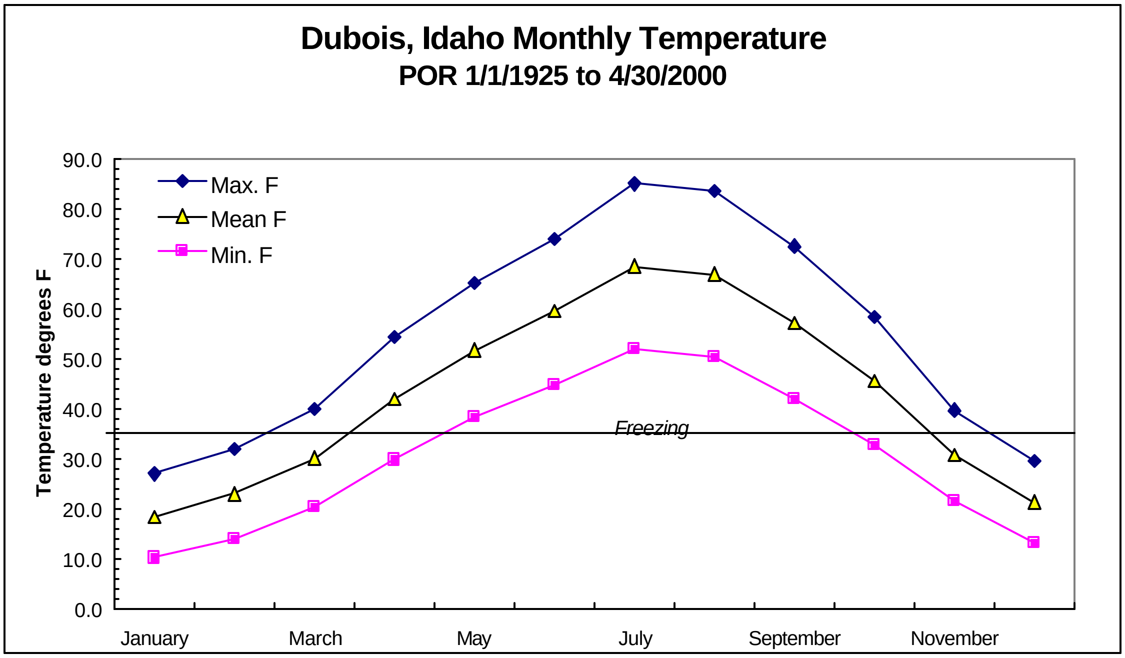


Figure 3. Average monthly temperature for Dubois, ID

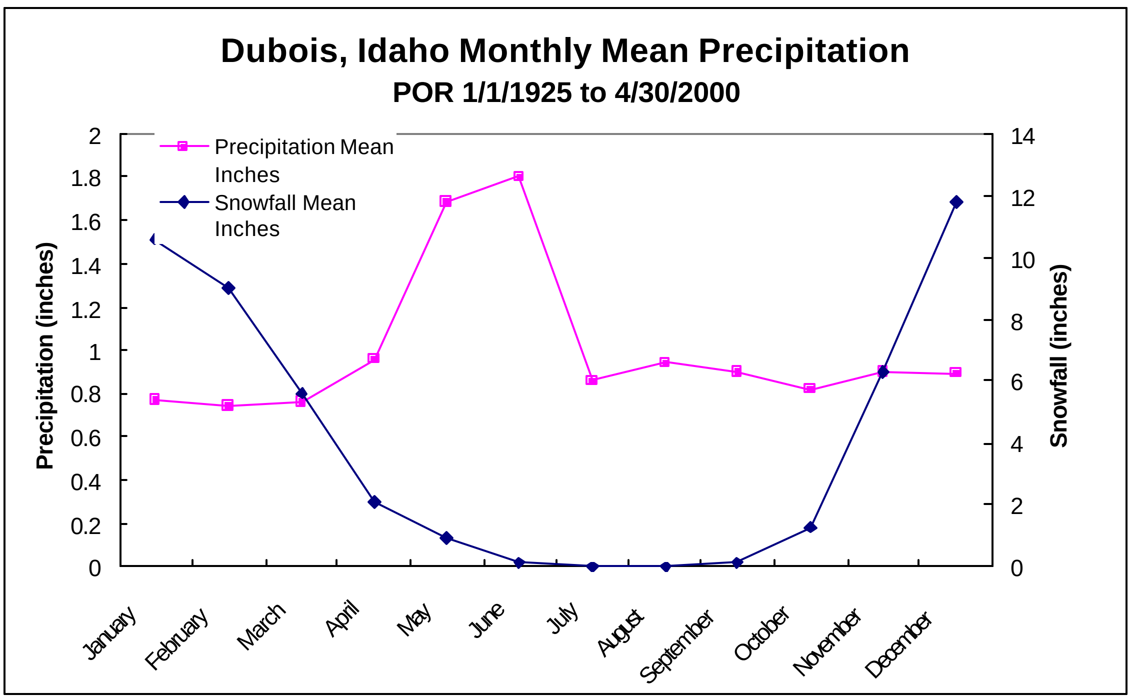


Figure 4. Average monthly precipitation for Dubois, ID

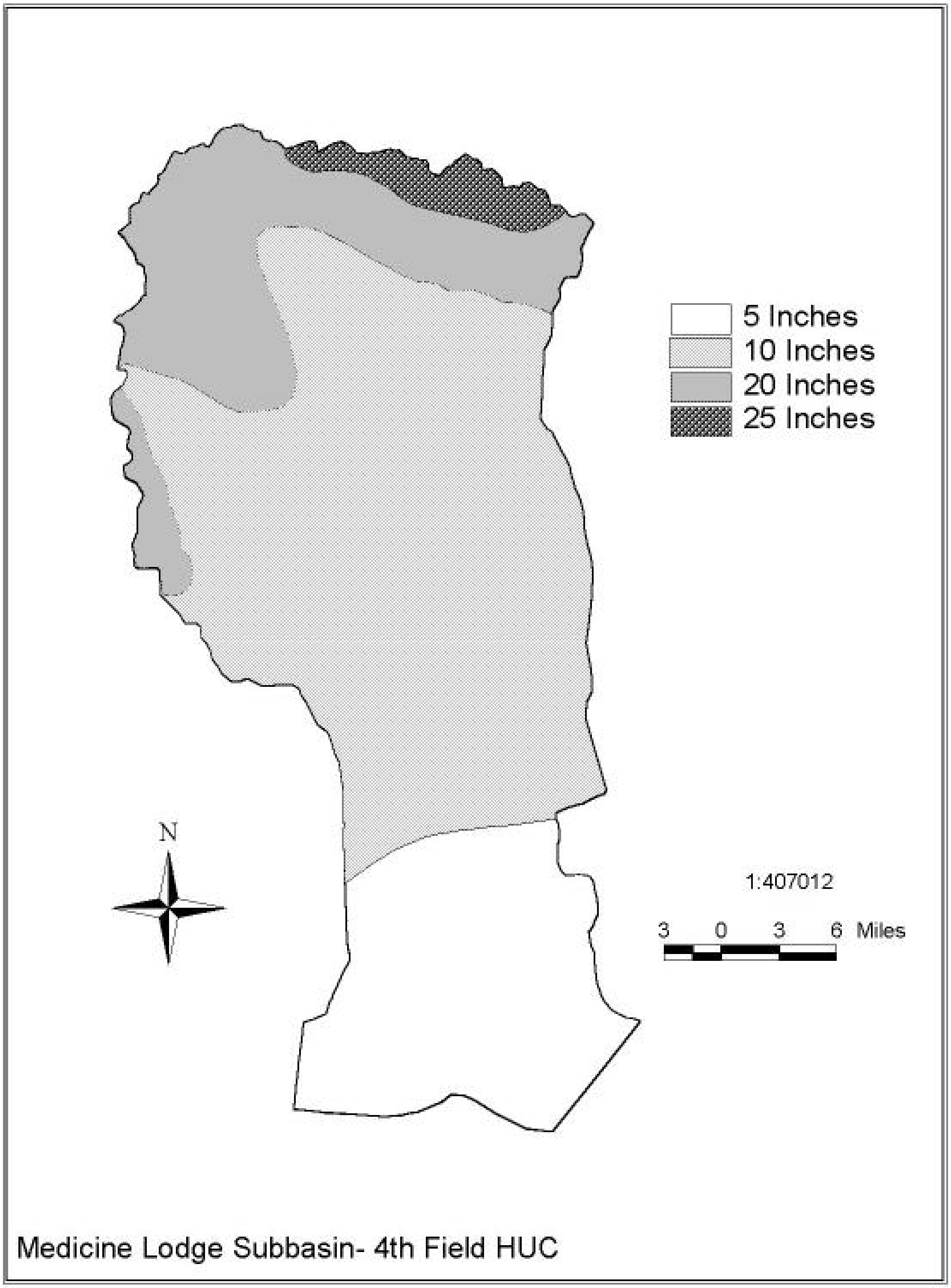


Figure 5. 1995 Precipitation

Geology

The Bureau of Land Management (BLM 2001) provided the following geologic description. See Figure 6 for a map of Medicine Lodge Subbasin geology.

> The Medicine Lodge Subbasin includes portions of the Northern Rocky Mountain physiographic province and the Eastern Snake River Plain section of the Colombia Intermontane physiographic province. The boundary between these provinces is characterized by the distinctive rise in topography that is evidenced north of Lidy Hot Springs, Winsper, and Small.
>
> The Northern Rocky Mountain physiographic province is characterized by a number of mountain ranges and intervening valleys that have developed on the Idaho batholith and other subsidiary igneous intrusions. These mountain ranges, which include the Beaverhead Range in the northern portion of the Subbasin, consist of metamorphic and sedimentary rocks of Precambrian to Mesozoic age that have been subjected to intensive uplifting, faulting, and folding. Within the Subbasin, most of these deformed metamorphic and sedimentary units have been covered with a veneer of volcanic rhyolite, basalt, and welded tuff that are known locally as the Edie School Rhyolite and the Medicine Lodge Volcanics.
>
> In the late Cenozoic Era, during the later stages of the building of the mountain ranges of the Northern Rocky Mountain province, the mountain province was dissected by an extensive rifting in the earth's crust which created a broad trough that filled with volcanic rocks. This trough, which extends in an arcuate pattern across southern Idaho, is known as the Snake River Plain. The basalt flows that underlie the Snake River Plain are many thousands of feet thick. Volcanic vents or eruptive centers such as Cedar Butte, Camas Butte, and Table Butte are common in the southern third of the Subbasin. Over much of the southern portion of the subbasin, the basalt has been covered with a veneer of wind blown sediments. In the Mud Lake/Terreton area, the basalt has been covered with lake sediments left behind as the Pleistocene age Lake Terreton evaporated, leaving Mud Lake as its remnant. Figure 6 displays the dominant geology types in the watershed.
>
> Over much of the southern portion of the subbasin, the basalt has been covered with a veneer of wind blown sediments. In the Mud Lake/Terreton area, the basalt has been covered with lake sediments left behind as the Pleistocene age Lake Terreton evaporated, leaving Mud Lake as its remnant.

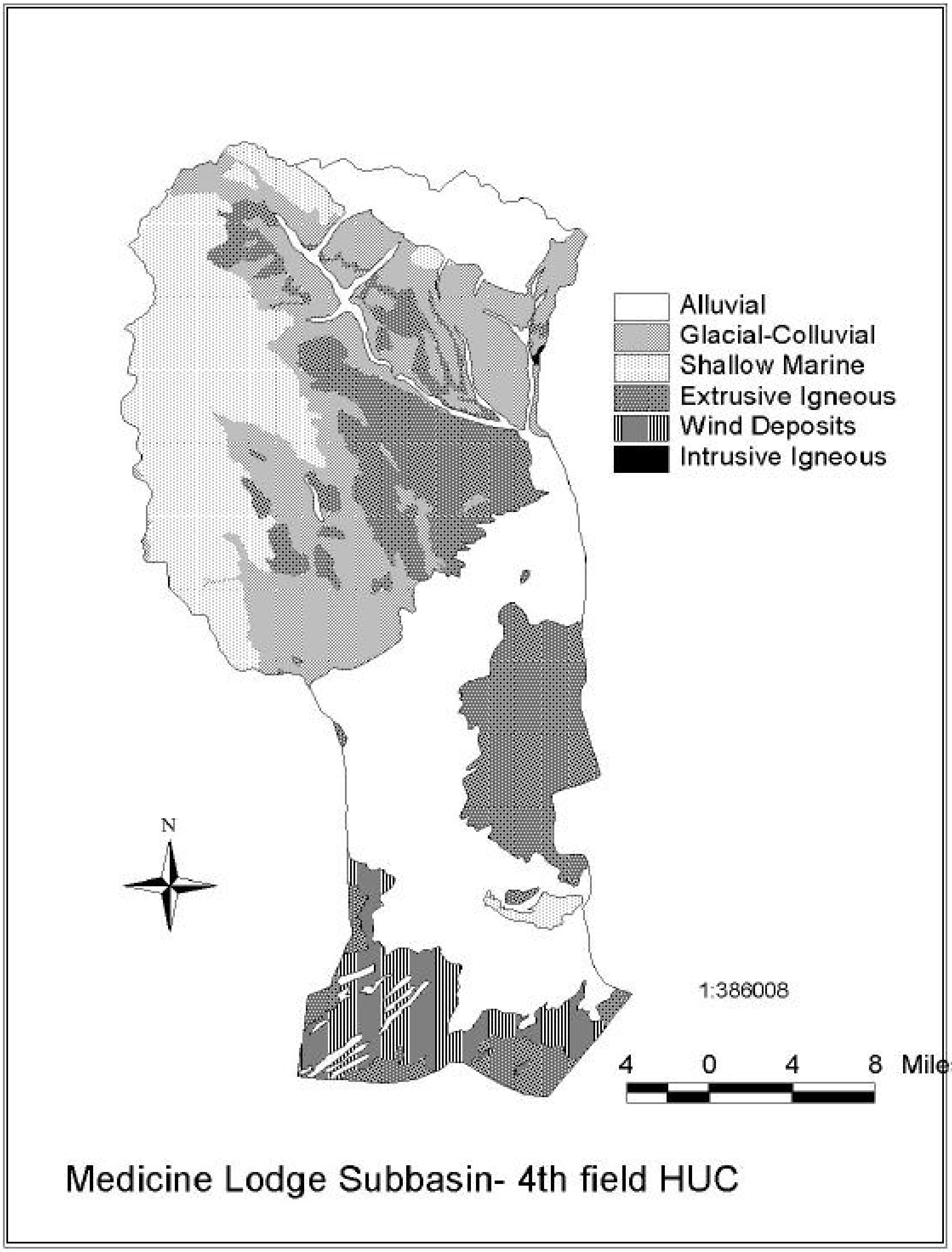


Figure 6. Geology of the Medicine Lodge Watershed

Soils

The soils in the Medicine Lodge Subbasin vary dramatically as does the topography. The watershed borders the continental divide and moves down into the valley where the soil depth increases and the slope decreases. Basalt canyons and cliffs are found interspersed throughout the watershed with steep mountains along the continental divide. The majority of the soils in the Medicine Lodge Subbasin are predominantly composed of sand, loam and gravel.

The Map Unit Identification Numbers (MUID) along with a summary of the soil types for this area are shown in Table 3. The location of the MUID areas is shown in Figure 7. This is based on STATSGO data (NRCS 2000) and from the NRCS's STATSGO COMP and LAYER database files (NRCS 2000). STATSGO is the State Soil Geographic database that has been compiled by the National Cooperative Soil Survey (NCSS) and is led by the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). STATSGO is compiled by generalizing more detailed soil maps. Map unit composition for a STATSGO map is determined by transecting or sampling areas on the more detailed maps and expanding the data statistically to characterize the whole map unit (NRCS 2000).

The summary of the STATSGO data found in Table 3 contains average soil slope, soil depth and the average K factor (Hoover 2000). These are weighted averages for the entire polygon of the MUID.

K-factor is a measure of erodibilty used in the Universal Soil Loss Equation. It measures the tendency of a soil to erode based on the soil texture, organic matter content, soil structure and permeability. The soil is given a score from 1.0 to 0.1, where 1 is extremely erosive and 0.1 is nearly non-erosive. Soils in the subbasin have a fairly low to moderate K-factor with none over 0.3 (Figure 8). The majority of the soils that are in the drainage area are between 0.1 and 0.15. Within the entire subbasin, the most erosive soils are found in the area south of the streams in the lower section of the HUC where Mud Lake is located. The most non-erosive soils are found along the continental divide, which is also where the highest elevations and the shallowest soils are found.

Soil slope is another factor in assessing the erodibilty risk of a system. The soil slope data was also gathered from the NRCS's STATSGO database and given as a weighted average (Figure 9). As expected, the greatest slopes were found along the continental divide in the north and west sides of the watershed. The slope generally decreases down into the valley to a 0-3% range, although there are some variations. The headwaters of the Medicine Lodge drainage system begins at Divide Creek where the slope is greater than 44%, but decreases to between 17% and 34% before joining with Warm Creek and Fritz Creek becoming Medicine Lodge Creek. Medicine Lodge Creek flattens to between 9% and 17% below

Spring Hollow and again decreases to between 3% and 9% below the confluence with Indian Creek.

The depth of soil in the subbasin is depicted in Figure 10. The deepest soils, greater than or equal to 60 in, are found primarily in the southern third of the subbasin near Mud Lake.

Table 3. Medicine Lodge Subbasin STATSGO soil summary

MUID	Acres	Sq Mi.	Name	Avg Slope (%)	Avg K Factor	Avg Depth (in)	Soil Texture (Surface)
ID114	256.471	0.4	Bereniceton-Diston-Grassy Butte-Dune Land-Rock Outcrop-Modkin	15.97	0.13	45.71	Sand (46%), very stony-loam (26%). Some loamy sand, clay loam, unweathered bedrock, and sandy loam.
ID115	11,062.39	17.285	Grassy Butte-Diston-Rock Outcrop-Malm-Matheson-Lidy-Zwiefel	7.485	0.11	50.91	Loamy sand (53%), 19% sand. Some extremely stony-loamy sand, unweathered bedrock, sand loam, fine sand and extremely stony-sandy loam.
ID134	97,934.66	153.023	Montlid-Fluvaquents-Terreton-Zwiefel	0.565	0.26	60.00	Sandy loam (79%), loamy sand (13%). Some clay loam and silty clay.
ID135	11,190.65	17.486	Levelton-Fluvaquents-Terreton-Zwiefel	0.815	0.25	60.00	Loamy sand (31%), loam (30%). Some sandy loam, silty clay, and fine sand.
ID137	11,071.60	17.299	Aecet-Bereniceton-Terreton-Bondfarm-Malm-Pancheri-Rock Outcrop	17.225	0.18	37.73	Very stony-loam (43%), unweathered bedrock (26%), silt loam (13%). Some loam, sandy loam, loamy sand, stony-silt loam and silty clay loam.
ID138	5,896.30	9.212	Aecet-Grassy Butte-Malm-Matheson-Rock Outcrop-Terreton	8.85	0.17	40.00	Loamy sand (60%), very stony-silt loam (13%), and silty clay loam (12%).
ID140	67,283.15	105.13	Bereniceton-Harston-Medicine-Mccaleb-Whiteknob-Packham-Lidy-Matheson	3.015	0.21	57.86	Gravelly-loam (47%), loam (44%). Some clay loam, silty loam and very gravelly-loam.

MUID	Acres	Sq Mi.	Name	Avg Slope (%)	Avg K Factor	Avg Depth (in)	Soil Texture (Surface)
ID160	36,977.31	57.777	Paint-Simeroi-Whitecloud	5	0.12	60.00	Gravelly loam (96%) and some very gravelly loam.
ID164	35,342.81	55.223	Crystal Butte-Fourme-Judkins-Stringam-Sudpeak-Targhee-Tineman	13.565	0.20	52.50	Gravelly loam (52%), loam (46%), and some silty loam.
ID165	37,347.44	58.355	Aecet-Atomic-Bondfarm-Malm-Matheson-Rock Outcrop	9.465	0.19	29.17	Silty loam (39%), fine sandy loam (36%), loam (15%), and unweathered bedrock (10%).
ID172	82,244.68	128.507	Fritz-Hagenbarth-Latigo-Parkalley-Poso-Rubble Land-Windicreek-Zeebar	25.975	0.14	58.57	Gravelly loam (78%), Gravelly-silt loam (12%). Some extremely gravelly-loam and fragmented material.
ID178	126,006.01	196.884	Custco-Deadhorse-Deecree-Horseridge-Latigo-Mogg-Rock Outcrop-Shagel-Small-Truble-Westindian-Zeebar-Zer	15.67	0.15	44.00	Gravelly-silty loam (35%), silt loam (30%), gravelly-loam (14%). Some unweathered bedrock, extremely stony-loam, and gravelly loam.
ID184	15,302.28	23.91	Rock Outcrop-Rubble Land-Cryoborolls-Typic Cryorthents	52.425	0.03	22.50	Unweathered bedrock (40%), fragmented material (25%), stony-loam (25%), and some variable.
ID194	43,190.68	67.485	Cryoborolls-Cryochrepts-Koffgo-Lag-Rock Outcrop-Rubble Land	52.395	0.05	42.50	Very stony-loam (34%), fragmented material (22%), unweathered bedrock (21%). Some stony-loam, cobbly-loam, very gravely-loam, and very cobbly.

Slopes, K factor and depth are weighted averages.

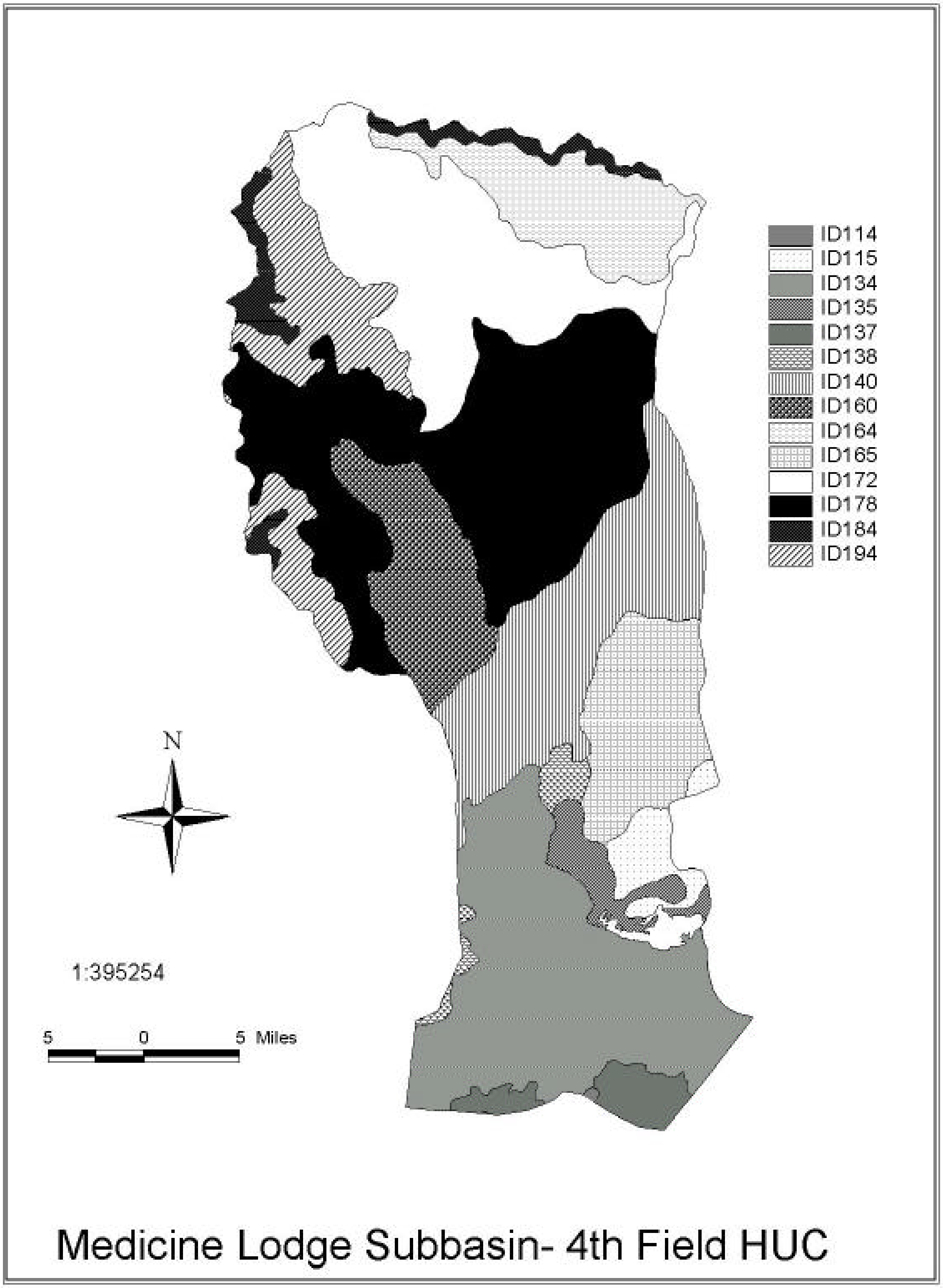


Figure 7. STATSGO Soil Map Unit Identifications

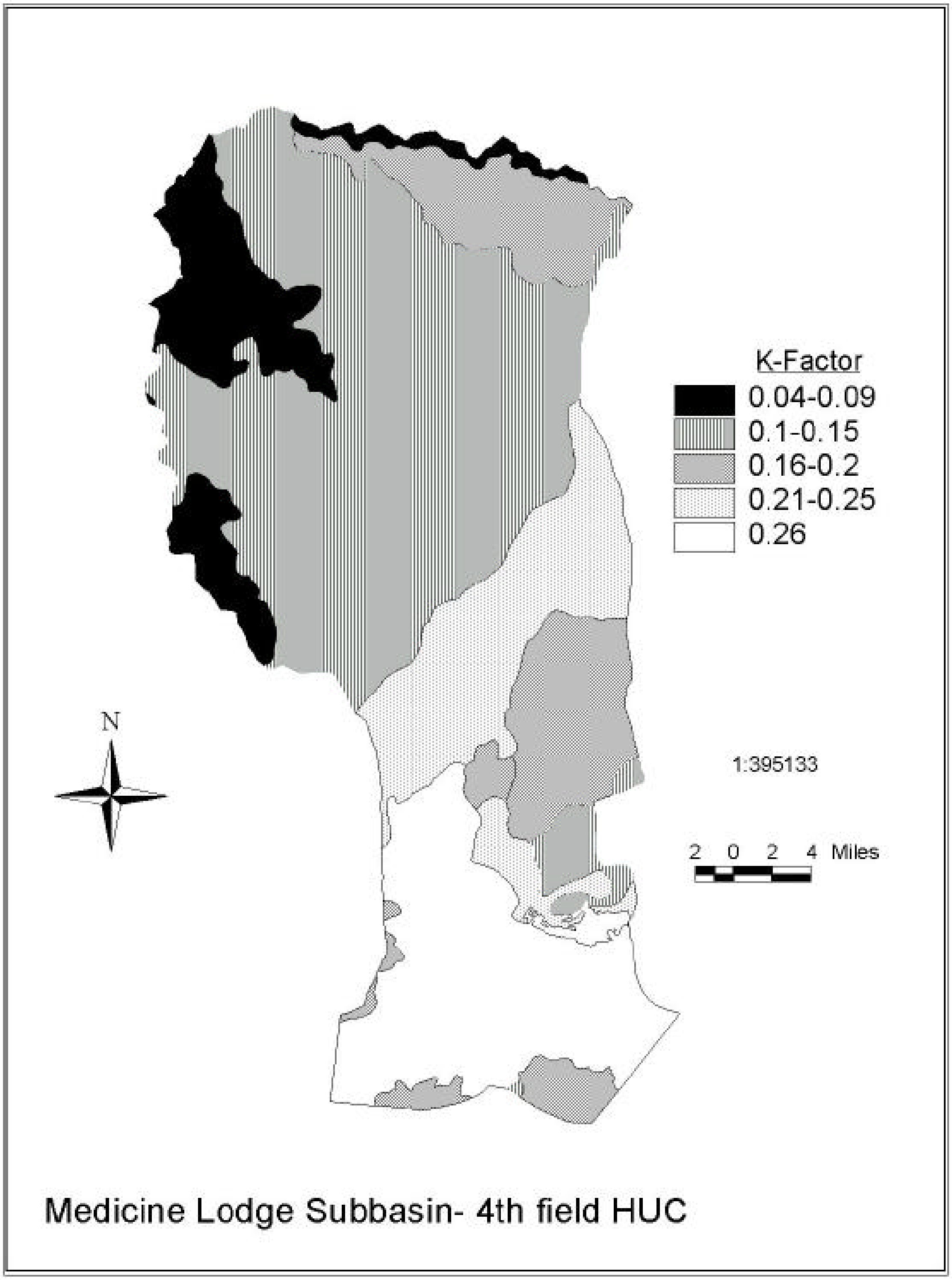


Figure 8. Soil Erosion Potential

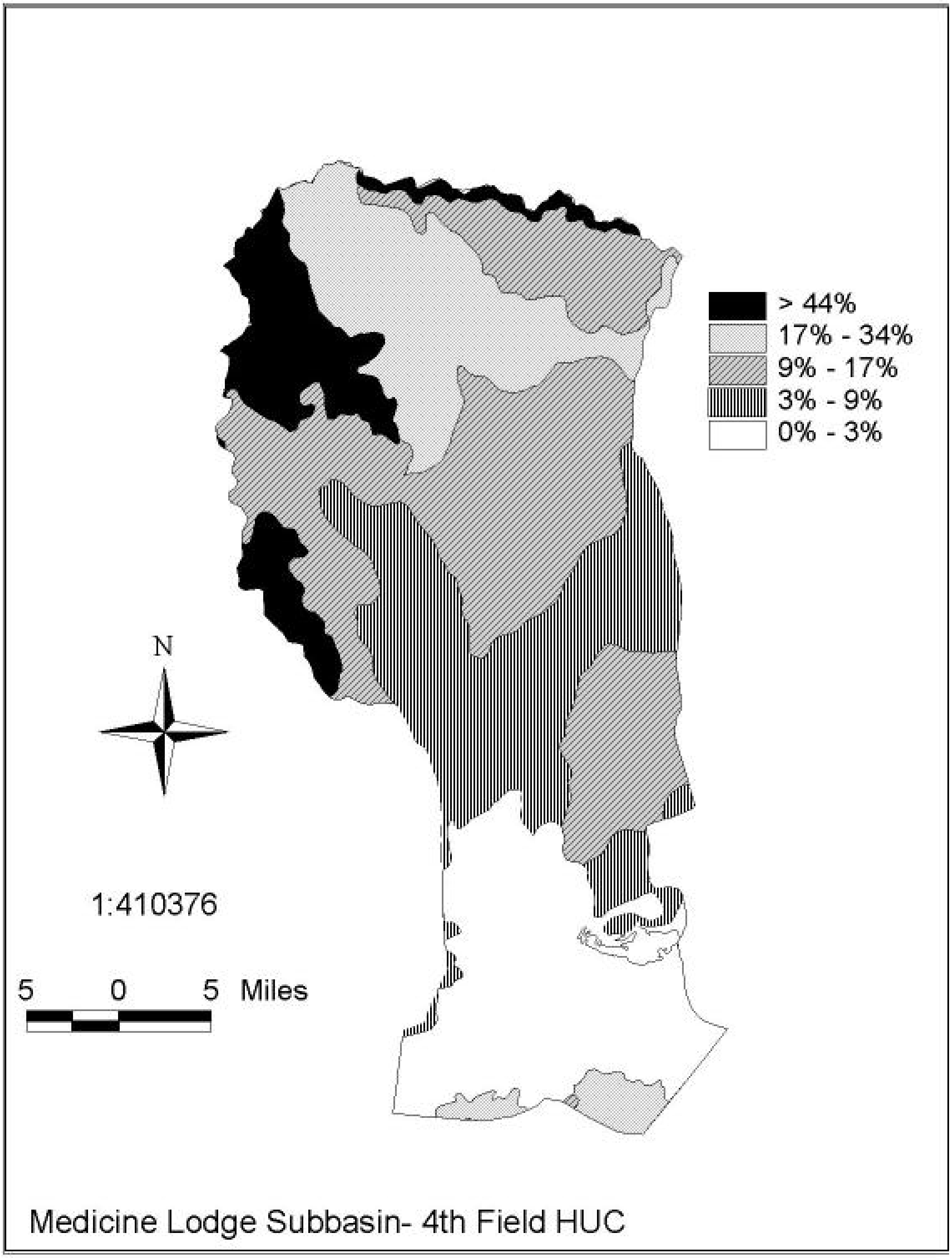


Figure 9. Soil Slope

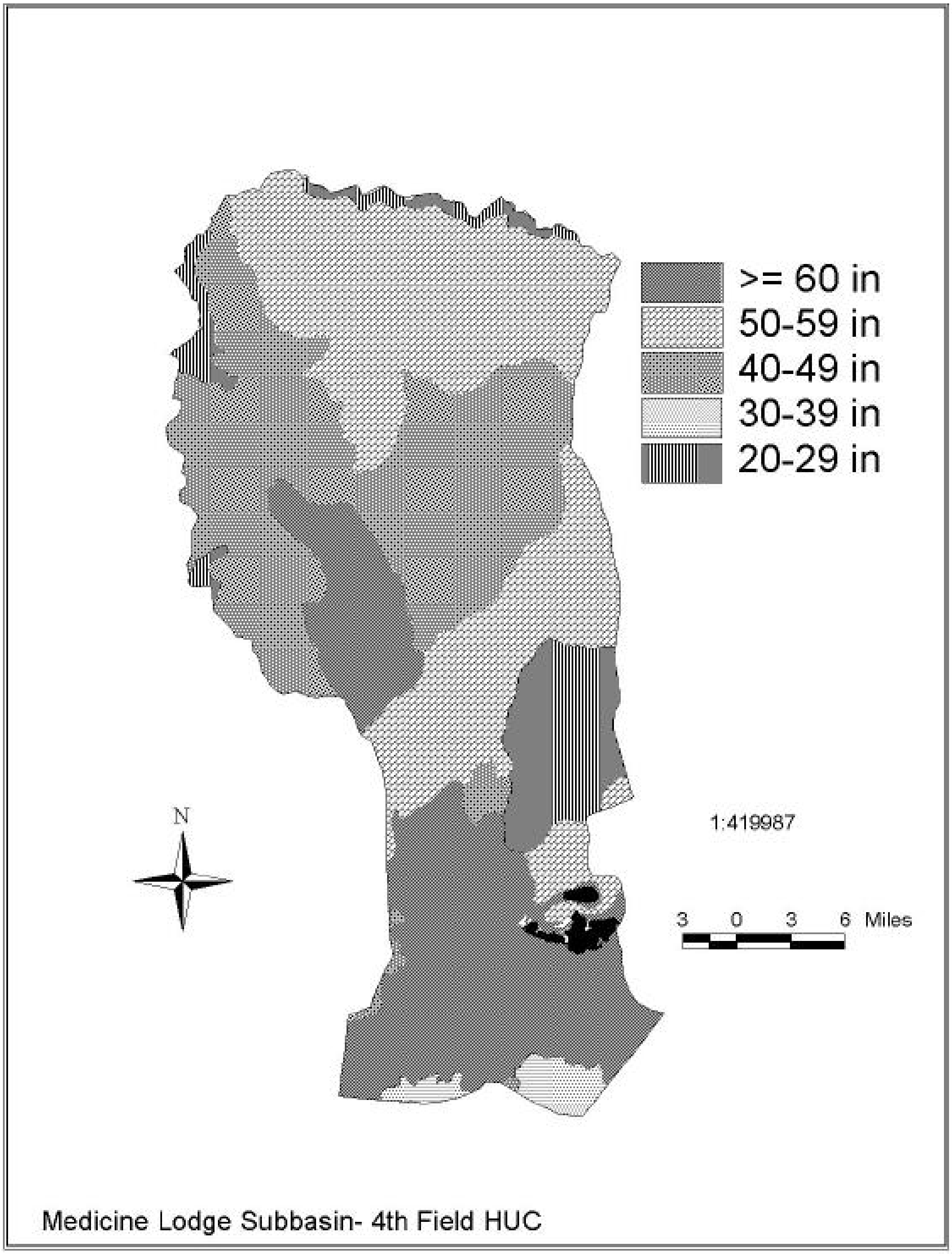


Figure 10. Soil Depth

Fisheries

The Medicine Lodge drainage is a closed drainage disconnected to adjacent drainages by ancient geologic formations. In addition to Medicine Lodge Creek and its tributaries, there are several sub-watersheds to the west included in this assessment, including Deep Creek, Warm Springs Creek and Crooked Creek (see Figure 2). Currently there are three species of salmonids in the Medicine Lodge Drainage. These include Yellowstone cutthroat (*Oncorhynchus clarki*), brook trout (*Salvelinus fontinalis*) and rainbow trout (*Oncorhynchus mykiss*). Although brook trout and rainbow trout have been introduced, there is debate over the origination of the Yellowstone cutthroat in the drainage.

The Idaho Department of Fish and Game stocked rainbow trout from 1968 through 1982. They typically introduced between 1000 to 2500 pounds of rainbow trout every year (Figure 11). There are no stocking records for brook trout.

The controversy over the Yellowstone cutthroat occurs for several reasons. In a report for the USGS of Montana in 1872, F.V. Hayden described the Medicine Lodge drainage as such, "I think I never saw a stream, large or small, more fully crowded with trout. There were two species, each equally abundant; and yet this stream sinks beneath the surface and is lost entirely twenty-five miles before reaching Snake River." This report shows that there were large amounts of salmonids in the drainage early in our settlement history. If settlers had introduced the fish, it is hard to believe that they had become so abundant in such a short period of time, so it stands to reason that there was some type of salmonid in the drainage prior to European settlement of the area. With this information, it is generally assumed that the Yellowstone cutthroat is an indigenous species to the Medicine Lodge drainage and has been managed as a wild trout fishery (Figure 12).

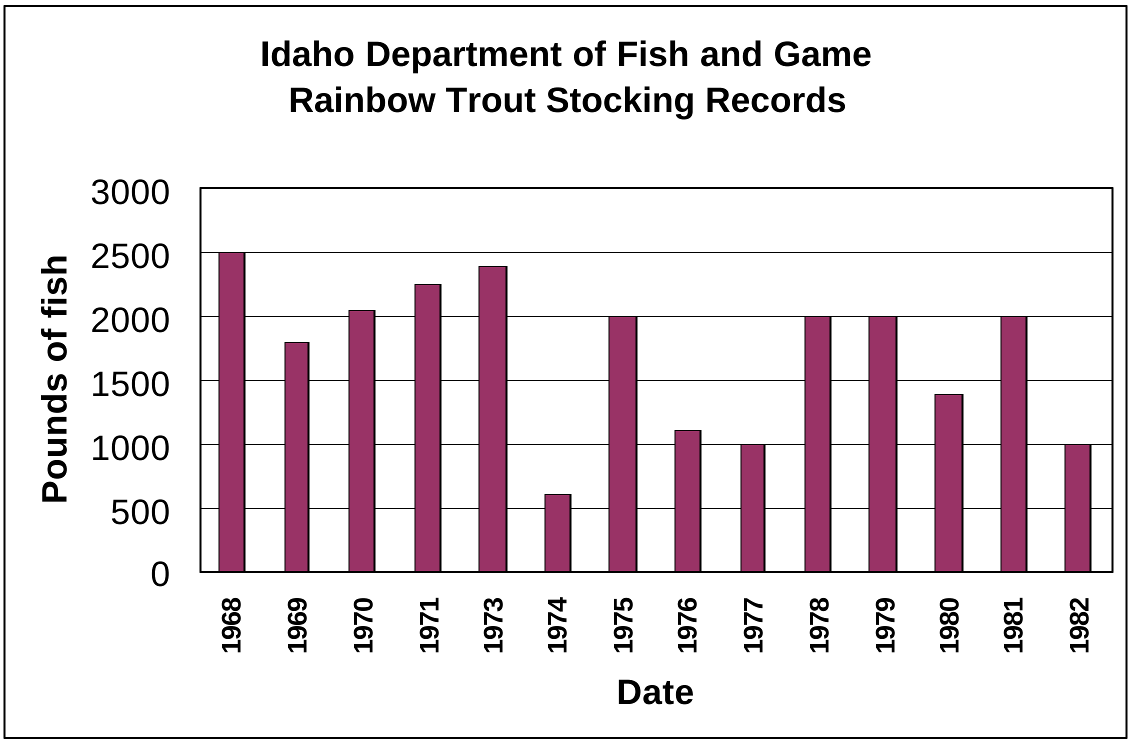
The Yellowstone cutthroat is considered a state sensitive species in Idaho and is carefully managed by the Idaho Department of Fish and Game. In 1998 it was petitioned to become a threatened species, but after review in February, 2001, the U.S. Fish and Wildlife Service declined the petition to list the Yellowstone cutthroat under the Endangered Species Act.

The population of the Yellowstone cutthroat in the drainage has been depressed in part as a result of the rainbow trout and brook trout populations. Rainbow trout pose a challenge due to their ability to hybridize with the Yellowstone cutthroat creating a population of impure genetics. Brook trout are also a challenge for the Yellowstone cutthroat due to competition. These fish are very unlikely to live together since brook trout generally have more success in breeding and competing for space.

Hybridization has been documented between rainbow trout and Yellowstone cutthroat trout in every stream in the HUC except for Crooked Creek and the west fork of Irving Creek. The presence of a pure Yellowstone cutthroat population in Crooked Creek is documented only by the USFS data. The USFS practices at that time did not include the measuring of fish caught, so there is no way to determine the age classes of Yellowstone cutthroat for this stream with the current data. Crooked Creek is a closed system without a documented presence of rainbow trout, which has most likely allowed the group to remain genetically pure. The west fork of Irving Creek was also fished without sign of hybridization although hybrids were found in the lower stem of the creek.

Medicine Lodge Creek also contains non-salmonid species of fish, including the short-headed sculpin (*Cottus confusus*) which are found in the majority of the tributaries as well as the main stem of Medicine Lodge Creek. Western mosquito fish (*Gambusia affinis*), a warm water species, have also been found in Warm Springs Creek and have obviously been introduced although there are no records of this.

Figure 11. Idaho Fish and Game Rainbow Trout Stocking Records



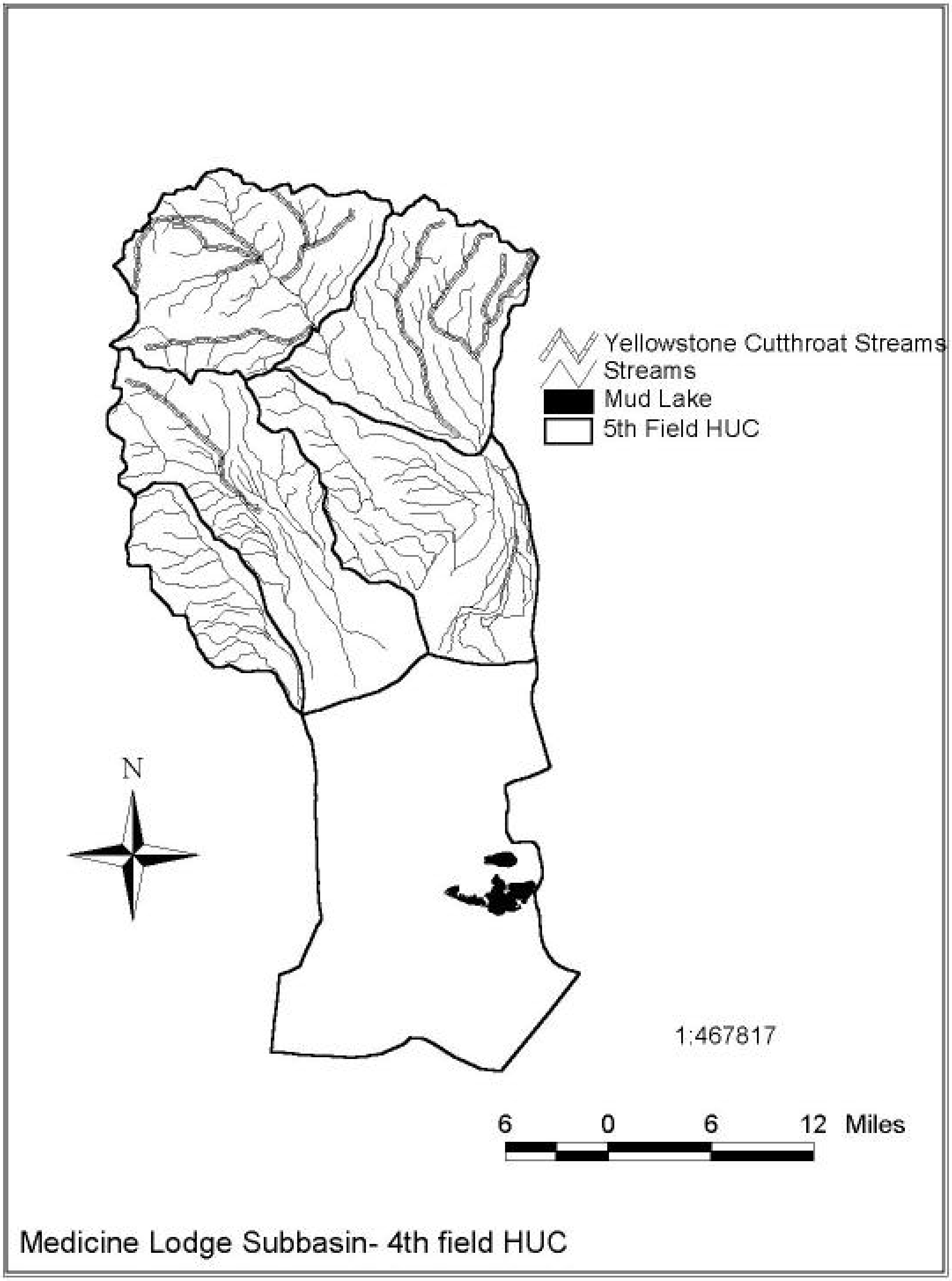


Figure 12. Yellowstone Cutthroat Trout Distribution

Sub-Watershed Characteristics

The Medicine Lodge Subbasin has six sub-watersheds. These are also the fifth field hydrologic units defined by the USGS. The fifth field HUCs are shown in Figure 13 and their attributes are summarized in Table 4. The relief ratio has been calculated for each sub-watershed by taking the difference in elevation between the high point on a watershed divide and its pour point divided by the length of the watershed. A relief ratio of zero indicates that the watershed is completely flat and has no erosive power. The Mud Lake sub-watershed is the closest to a "flat" situation, with a relief ratio of 0.004. The sub-watershed with the highest relief ratio is the Divide Creek watershed which borders the continental divide.

The drainage density provides a relative measure of transport efficiency as well as a measurement of the average spatial diversity of a stream system. It is calculated by dividing the total length of streams by the land area. The drainage density for the Mud Lake sub-watershed is given a zero because there are no stream channels in this area, only drainage canals. The highest drainage density in the watershed is in the Medicine Lodge Creek sub-watershed with 1.278 miles of stream for every square mile of area.

For comparable geology and soils, a watershed with greater relief ratio and drainage density would tend to have a greater natural sediment yield as well as higher potential for accelerated erosion due to land surface disturbances.

Table 4. Physical attributes of 5th field HUCs in the Medicine Lodge Subbasin

HUC5 Name	Area (mi^2)	Total # of stream miles	Dominant Aspect	Elevation Range		Relief Ratio	Drainage Density (mi/mi^2)
				Pour Point	High Point in watershed		
Chandler Canyon	57.9	70.21316	SE	4862 ft	9877 ft	0.060	1.213
Divide Creek	134.5	134.0186	SE	6198 ft	10963 ft	0.074	0.996
Indian Creek	124.5	128.5036	S-SE	5517 ft	9166 ft	0.045	1.032
Medicine Lodge Creek	146.1	186.6795	SE	4861 ft	8426 ft	0.029	1.278
Mud Lake	297.1	0	S	4700 ft	5200 ft	0.004	0
Warm Springs Creek	153.9	152.1972	SE	4832 ft	11284 ft	0.049	0.989

Drainage density is based on 1:100k GIS hydrography, excluding canals

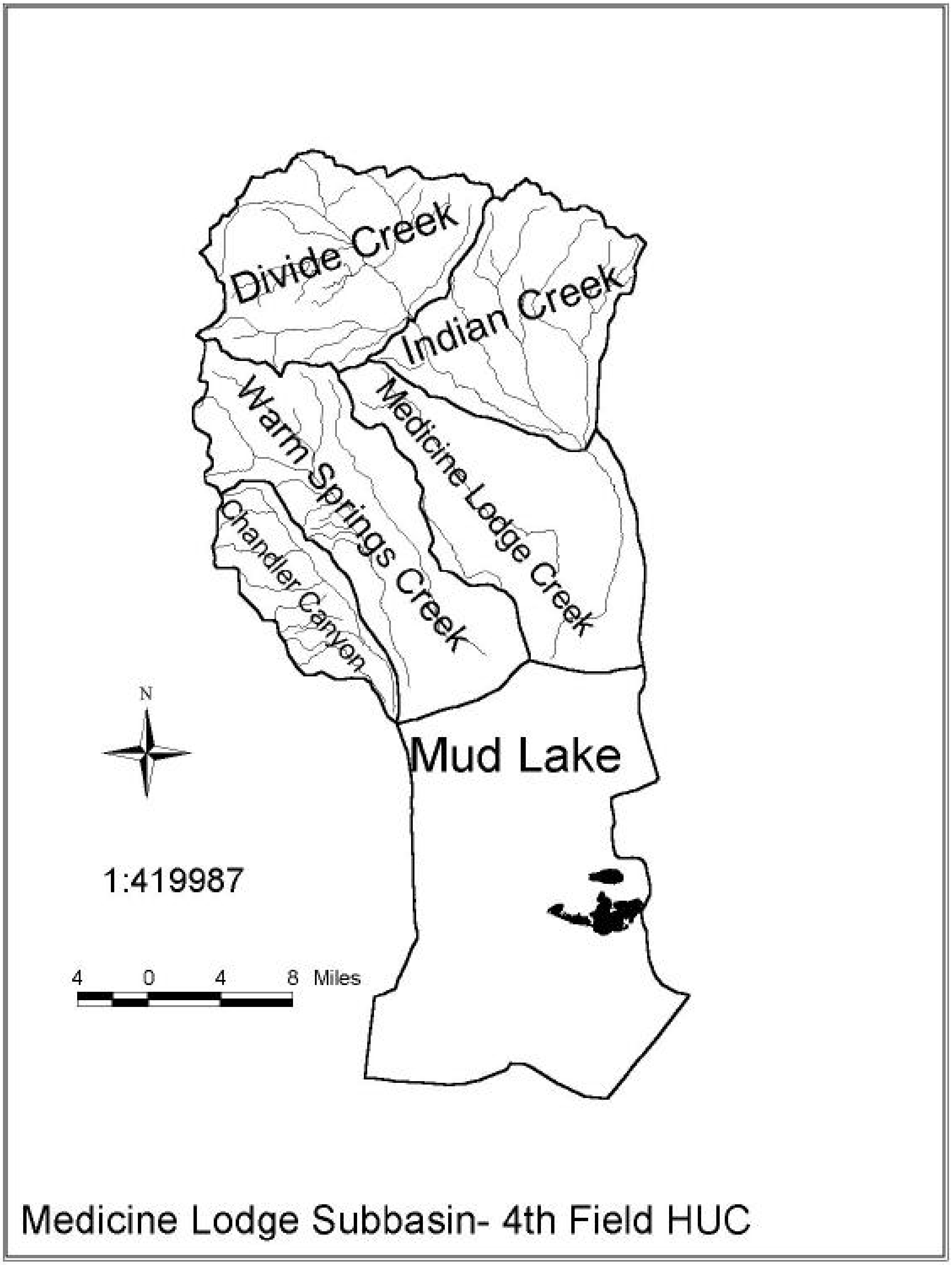


Figure 13. 5th Field Watersheds

Stream Characteristics

The geomorphic characteristics of the streams in the Medicine Lodge Subbasin vary considerably. Table 5 contains a summary of the subbasin's geomorphic characteristics. Much of the data for this table was collected from the DEQ BURP (Beneficial Use Reconnaissance Program). The overall stream gradient was calculated from 1:100,000 scale hydrographic GIS coverage. The valley and channel classifications are based on Rosgen and were compiled from the DEQ BURP data.

Table 5. Geomorphic Characteristics of streams in the Medicine Lodge Subbasin

Stream	WBID No.	HUC5 Name	Valley Type	Rosgen Channel Type	Overall Stream Gradient (%)	Dominant Substrate	Avg. Width/ Depth ratio
Crooked Creek	21	Warm Springs Creek	U-shaped	G	3.0	silt/clay	20
Deep Creek	18	Medicine Lodge Creek	U-shaped	B	1.0	silt, sand	21
Divide Creek	14	Divide Creek	Trough-like	B	2.0	silt/clay	47
Dry Creek	9	Indian Creek	U-shaped	C	3.0	coarse pebble, small cobble	22
Edie Creek, at BLM	10	Divide Creek	Trough-like	B	3.0	silt, small cobble	
Edie Creek, lower	10	Divide Creek	Flat-bottom	B	4.0	silt/clay	44
Fritz Creek, lower	16	Divide Creek	Flat-bottom	F	1.0	silt, sand	
Fritz Creek, S. Fork	16	Divide Creek	U-shaped	B	3.0	silt, coarse pebble	18
Fritz Creek, upper	16	Divide Creek	Trough-like	B	2.5	silt/clay	
Fritz Creek, N. Fork	16	Divide Creek	U-shaped	B	3.0	silt/clay	44
Horse Creek, lower	15	Divide Creek	U-shaped	G	2.5	silt/clay	17
Horse Creek, upper	15	Divide Creek	Trough-like	F	3.0	coarse pebble	19
Indian Creek	3	Indian Creek	Flat-bottom	F	0.5	coarse pebble	12
Indian Creek, W. Fork	5	Indian Creek	U-shaped	B	3.5	coarse pebble, small cobble	17
Irving Creek, E. Fork	12	Divide Creek	Flat-bottom	B	3.0	silt, coarse pebble	14
Irving Creek, lower	12	Divide Creek	Flat-bottom	C	3.0	silt, coarse pebble	

Steam Name	WBID No.	HUC5 Name	Valley Type	Rosgen Channel Type	Overall Stream Gradient (%)	Dominant Substrate	Avg. Width/ Depth ratio
Irving Creek, upper	12	Divide Creek	U-shaped	C	2.5	silt, coarse pebble	18
Medicine Lodge Creek	2	Medicine Lodge Creek	Trough-like	B	2.0		
Medicine Lodge Creek	6	Medicine Lodge Creek	Flat-bottom	B-C	2.0		16
Medicine Lodge Creek	11	Divide Creek	U-shaped	F	2.0	silt, coarse pebble	
Middle Creek	7	Indian Creek	Box Canyon	C	3.5	silt, coarse pebble	26
Middle Creek	8	Indian Creek	U-shaped	A	3.0	coarse pebble, small cobble	9.1
Myers Creek	21	Warm Springs Creek	U-shaped	B	3.0	silt, coarse pebble	13
Warm Creek, lower	13	Divide Creek	Flat-bottom	F	0.9	silt/clay	
Warm Creek, upper	13	Divide Creek	Trough-like	B	1.6	silt/clay	
Warm Springs Creek, lower	20	Warm Springs Creek	Box Canyon	E	0.9	silt/clay	
Warm Springs Creek, upper	20	Warm Springs Creek	Box Canyon	C	1.0	silt/clay	
Webber Creek, lower	17	Divide Creek	U-shaped	B	2.0	silt, coarse pebble	48
Webber Creek, upper	17	Divide Creek	V-shaped	B	2.5	silt, coarse pebble	17
Wood Canyon Creek	8	Indian Creek	U-shaped	A	4.0	silt/clay, sand	12

References: Valley and channel type based on Rosgen 1993
Overall stream gradient calculated from GIS hydrography coverage
Dominant substrate and width/depth ratio compiled from DEQ BURP data

1.3 Cultural Characteristics

The area in the Medicine Lodge Subbasin is primarily agriculture with a very low population density. The majority of the watershed is in Clark County (Figure 2). The southern half of the subbasin is in Jefferson County.

The Medicine Lodge Subbasin's economy is primarily agriculture. The BLM and USFS have grazing allotments within the subbasin. The BLM manages 28 allotments with a total of 31,713 animal unit months (AUM) while the USFS has 13 grazing allotments with 17,957 AUMs. Much of the private land is also grazed. The public and private lands are grazed with sheep, cattle and buffalo. (Mickelson 2001)

The counties also produce field crops. The National Agricultural Statistics Service reported that Clark County produced 214,000 production bushels of Barley harvested off of 2300 acres of land. In Jefferson County there were 4,404,000 production bushels of Barley and 810,000 bushels of oats. (NASS 2000)

Land Use

The land in the Medicine Lodge Subbasin is 69% rangeland (Figure 14). Another 23% is agriculture with 7% forest. The forested area is found in the western part of the subbasin in the headwaters of Fritz Creek, Webber Creek and Crooked Creek. The majority of the agricultural land is found in the southern part of the subbasin which is primarily flat and devoid of much hydrography.

Road densities in Medicine Lodge are very low. Idaho Highway 22 cuts across the subbasin south of Small, ID and Highway 28 and 33 cross in the southern section. There are county and private roads throughout the subbasin. The road along Medicine Lodge Creek is paved (with patches unpaved) while the rest of the roads in the subbasin are unpaved.

Table 6. Land use in the Medicine Lodge Subbasin (Anderson Level I).

Land Use Category	Acres	Square Mi.	Square Km.	% of Total
Forest	44,712	70	181	7%
Irrigated-Gravity Flow	74,959	117	303	12%
Irrigated-Sprinkler	64,936	101	263	11%
Rangeland	418,672	654	1,694	69%
Total	**603,279**	**942**	**747**	**100%**

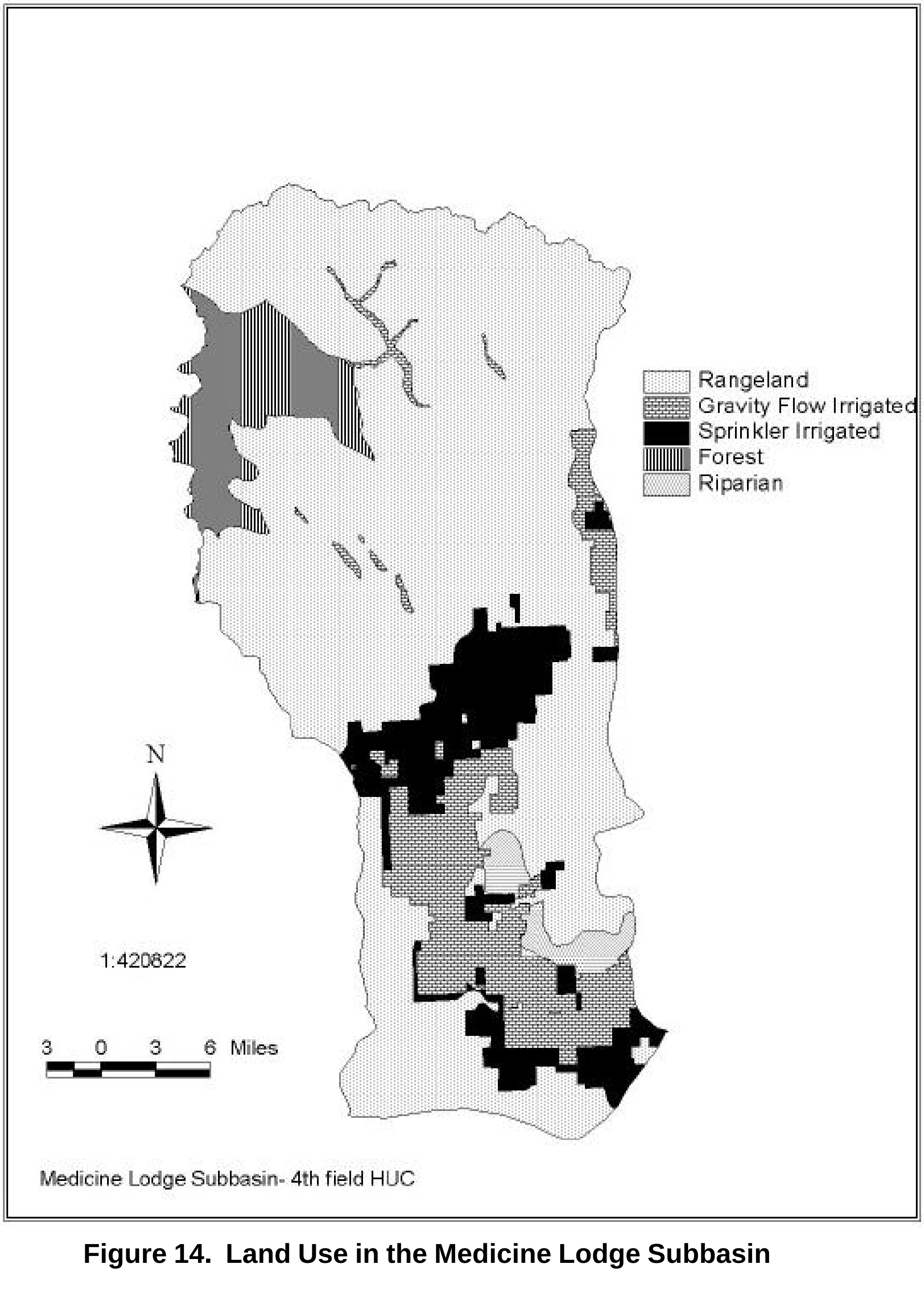


Figure 14. Land Use in the Medicine Lodge Subbasin

Land Ownership

The majority (69%) of the Medicine Lodge Subbasin is public land. The BLM manages 33% while the USFS manages 25%. The State of Idaho (Idaho Department of Lands) manages small land parcels interspersed throughout the BLM land totaling 4% of the watershed. 31% of the subbasin is owned privately, most of which lies in the southern half of the subbasin. The Idaho National Environmental Engineering Laboratory's boundaries enter the subbasin in the southwestern tip (7%).

Table 7. Land ownership in the Medicine Lodge Subbasin

Description	Acres	Square Miles	Square Km	% of Total
Private	**182,613**	**285**	**739**	**31%**
Public				
B.L.M.	192,346	300	778	33%
Department of Energy	39,617	62	160	7%
State of Idaho	20,930	33	85	4%
U.S. Forest Service	146,205	228	591	25%
Subtotal	**399,098**	**623**	**1,615**	**69%**
Total	**581,711**	**909**	**2,353**	**100%**

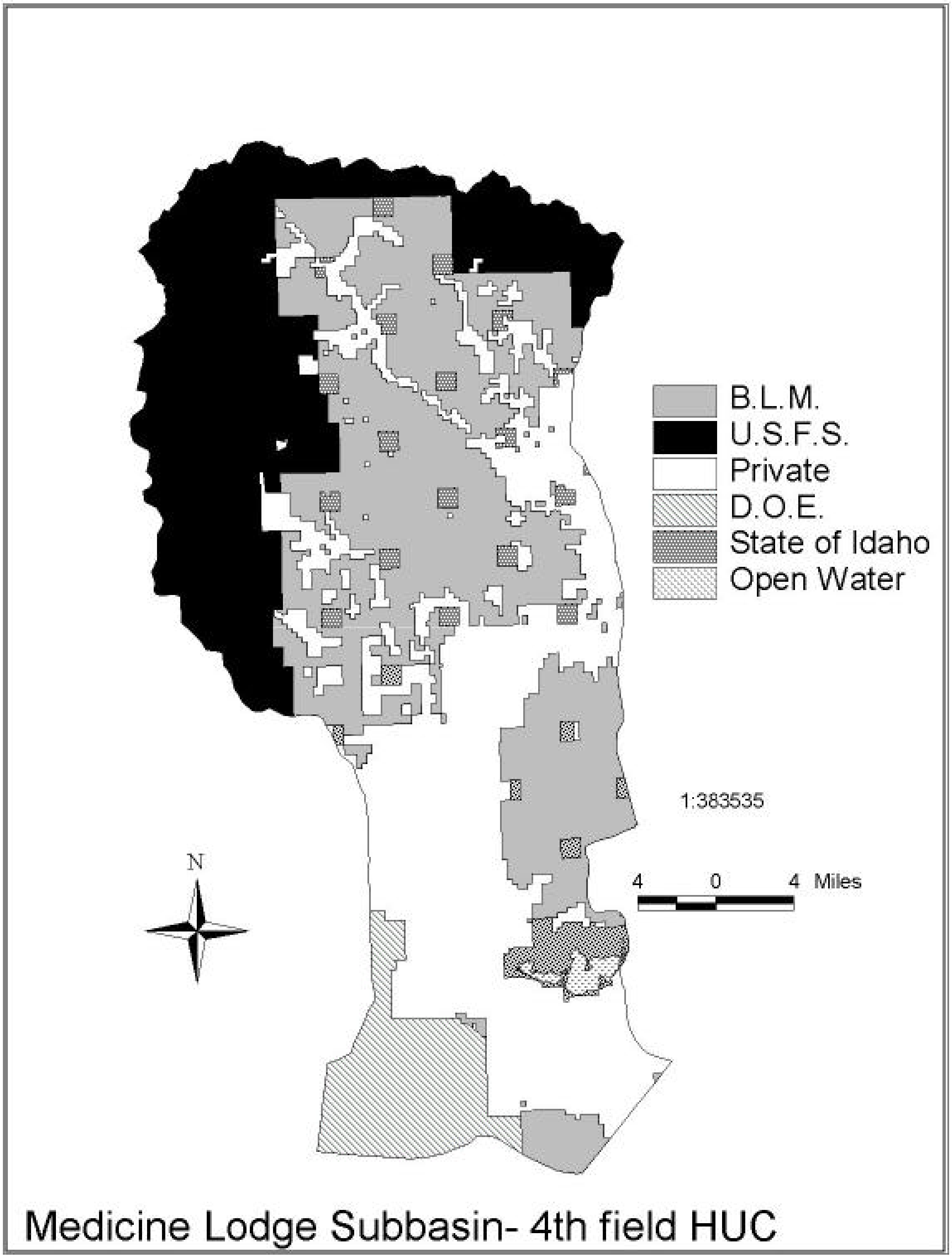


Figure 15. Land Ownership in the Medicine Lodge Subbasin

2. Subbasin Assessment – Water Quality Concerns and Status

2.1 Water Quality Limited Segments Occurring in the Subbasin

The Medicine Lodge Drainage has five stream segments that are included on the Idaho 1998 § 303(d) list. The 303(d) list is of waters that are impaired or that need further assessment, meaning that streams are not meeting the requirements of their beneficial uses. The stream segments are shown in Figure 16 and are described in Table 8. These streams were listed because of their presence in the *1992 Water Quality Status Report* (DEQ 1992) also known as the 305(b) report.

Warm Springs Creek was shown in Appendix A of the 1992 305(b) report to be in non-support of cold water aquatic life and salmonid spawning, and threatened for the use of agricultural water. Warm Creek was shown to be in non-support for primary contact recreation and in threatened support of agricultural water, cold water aquatic life, salmonid spawning, and secondary contact recreation.

Warm Creek was de-listed in 1996 because it was found to be in full support of its beneficial uses after assessment of the macroinvertebrate data from BURP. The boundaries of the 303(d) listing for Medicine Lodge Creek were also changed at this time decreasing the listed stream miles from 24.17 miles to 16.20 miles (DEQ 1998).

The Water Quality Working Committee in 1992-1994 (DEQ 1992-1994) nominated most of the streams that are now listed as stream segments of concern (SSOC). The streams nominated included Medicine Lodge Creek, Edie Creek and Irving Creek with the primary objective of maintaining or restoring water quality. The comments on the SSOC nominations were primarily focused on protecting the fisheries. People were also concerned with impact from recreation on Medicine Lodge Creek and poor livestock management on Irving Creek. None of these nominations became designated SSOCs in this watershed, which means that they obtained their listing status from the 305 (b) report. Table 8 lists the 303(d) listed streams within Medicine Lodge subbasin. Locations of listed streams are depicted in Figure 16. See Appendix C for the Water body identification numbers and their boundaries for the entire Medicine Lodge Subbasin.

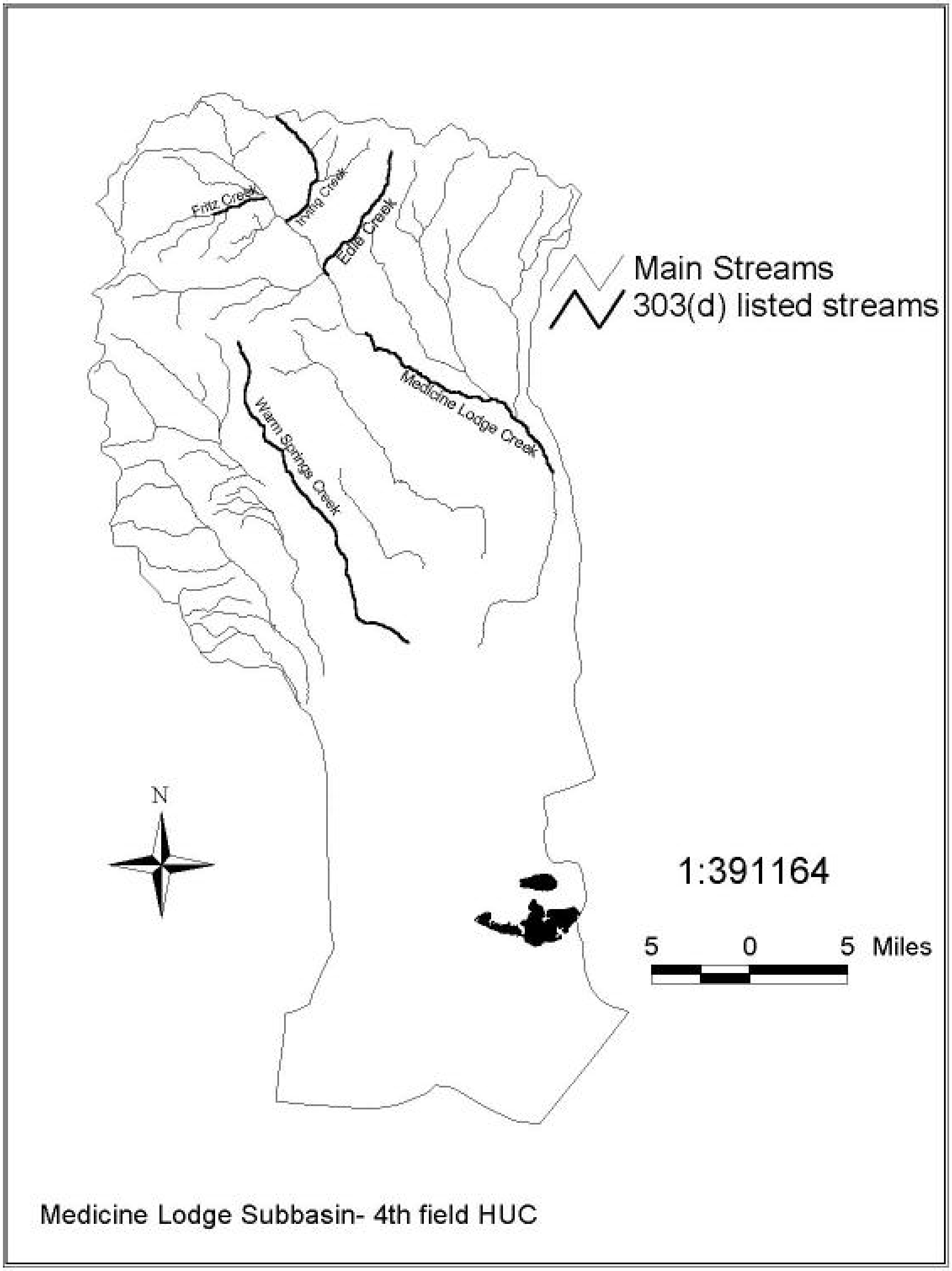


Figure 16. Medicine Lodge Subbasin 303(d) Listed Streams

Table 8. 1998 303 (d) streams in the Medicine Lodge Watershed

Stream	1998 303 (d) Boundaries	WBID No.	Pollutants	Listing Basis
Medicine Lodge Creek	Spring Hollow Creek to Small, ID	6,2	Flow Alteration, Sediment, Temperature	1992 305(b) appendix D
Edie Creek	Headwaters to Medicine Lodge Creek	10	Habitat Alteration, Nutrients, Sediment	1992 305(b) appendix D
Irving Creek	Headwaters to Medicine Lodge Creek	12	Habitat Alteration, Nutrients, Sediment	1992 305(b) appendix D
Fritz Creek	Forks to Medicine Lodge Creek	16	Nutrients, Temperature	1992 305(b) appendix D
Warm Springs Creek	Headwaters to Sinks	20	Nutrients, Sediment	1992 305(b) appendix A

2.2 Applicable Water Quality Standards

The Idaho water quality standards are designed to meet the goals of the Clean Water Act (CWA). The goal stated in the CWA that is especially relevant to designated uses is section 101 (a) (2) which states that:

> "wherever attainable, water quality should provide for the protection and propagation of fish, shellfish, and wildlife and provide for recreation in and on the water."

Idaho's water quality standards are published at *IDAPA 58.01.02-Water Quality Standards and Wastewater Treatment Requirements.* These standards consist of three parts: designated uses of waters, numeric or narrative criteria to protect those uses, and an antidegradation policy. Table 9 lists all of the designated beneficial uses for Medicine Lodge.

Designated Uses

The following is an excerpt from Idaho's water quality standards which lists the designated beneficial uses for surface waters:

Water Supply

a. Agricultural (AWS): water quality appropriate for the irrigation of crops or as drinking water for livestock. This use applies to all surface waters of the state.

b. Domestic (DWS): water quality appropriate for drinking water supplies.

c. Industrial (IWS): water quality appropriate for industrial water supplies. This use applies to all surface waters of the state.

Aquatic Life

a. Cold water aquatic life (CWAL): water quality appropriate for protection and maintenance of viable aquatic life community for cold water species.

b. Salmonid spawning (SS): waters which provide or could provide a habitat for active self-propagating populations of salmonid fishes.

Recreation

a. Primary contact recreation (PCR): water quality appropriate for prolonged and intimate contact by humans or for recreational activities when the ingestion of small quantities of water is likely to occur. Such activities include, but are not restricted to, those used for swimming, water skiing, or skin diving.

b. Secondary contact recreation (SCR): water quality appropriate for recreational uses on or about the water and which are not included in the primary contact category. These activities may be used for fishing, boating, wading, infrequent swimming and other activities where ingestion of raw water is not likely to occur.

Wildlife Habitats

Water quality appropriate for wildlife habitats. This use applies to all surface waters of the state.

Aesthetics

This use applies to all surface waters of the state.

Any water that does not have an official designated use is addressed in section 58.01.02.101 of the IDAPA, entitled "Undesignated Surface Waters". It states that, "Prior to designation, undesignated waters shall be protected for beneficial uses, which includes all recreational use in and on the water and the protection and propagation of fish, shellfish, and wildlife wherever attainable." These undesignated waters are presumed to support cold water aquatic life and primary contact recreation. Any use that has existed since November 28, 1975 is also protected if there is indicative information to show its presence. Industrial water supply, wildlife habitat and aesthetics are also designated for all waters of the state.

The Special Resource Water (SRW) designation is defined in the standards as a specific segment or body of water which is recognized as needing intensive protection to a) preserve outstanding or unique characteristics, or b) maintain a current beneficial use. The only stream with a SRW designation is Medicine Lodge Creek. The primary aim of the SRW designation is to protect beneficial uses against point sources of pollution eliminates any new point source from receiving a NPDES (National Pollutant Discharge Elimination System) and keeps any current source from increasing its discharge. Since there are no point sources of pollution in Medicine Lodge, this designation would keep any from being developed along the Medicine Lodge Creek. No new point sources will be allowed in any of the tributaries if their discharge would decrease the water quality in Medicine Lodge Creek.

Water Quality Criteria

Water quality criteria specify the chemical, physical and biological conditions that a stream must meet in order to achieve and protect a beneficial use. The criteria relevant to the Medicine Lodge Subbasin are discussed in sections 200, 250, 251, and 252 of the Idaho Administrative Code (IDAPA 58.01.02).

All of the 1998 303(d) listed streams in the subbasin are listed for sediment except for Fritz Creek. The water quality standards states that, "Sediment shall not exceed quantities…which impair designated beneficial uses." (IDAPA 58.01.02.200.08)

All of the 1998 303(d) listed streams in the subbasin except Medicine Lodge Creek are listed for nutrients. The water quality standards for excess nutrients states, "Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses." (IDAPA 58.01.02.200.06)

Medicine Lodge Creek and Fritz Creek are listed for temperature and both have designated beneficial uses of both Cold Water aquatic life and Salmonid Spawning. The temperature criteria is different for cold water aquatic life (CWAL) and for salmonid spawning (SS). For CWAL the standards states, "Water temperatures of twenty-two (22) degrees C or less with a maximum daily average of no greater than nineteen (19) degrees C." For SS the standards are, "Water temperatures of thirteen (13) degrees C or less with a maximum daily average no greater than nine (9) degrees C.

Antidegredation Policy

Idaho's Antidegredation Policy (IDAPA 58.01.02.051) maintains the existing uses for all waters by stating that "existing in stream water uses and the level of water quality necessary to protect existing uses shall be maintained and protected."

It protects high quality waters but allows for development by stating that, "where the quality of the waters exceeds levels necessary to support propagation of fish, shellfish and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the Department finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the Department's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the Department shall assure water quality adequate to protect existing uses fully."

The Antidegredation Policy also addresses outstanding resource waters. "Where high quality waters constitute an outstanding national resource, such as waters of national and state parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected from the impacts of point and nonpoint source activities."

Table 9. Designated Beneficial Uses for Medicine Lodge Subbasin

Stream	Boundaries	WBID No.	Aquatic Life	Recreation	Other
Mud Lake		1			
*Medicine Lodge Creek	Indian Creek to playas	2	COLD, SS	PCR	DWS, SRW
Indian Creek	confluence of Indian Creek forks to mouth	3			
Indian Creek, E. Fork	source to mouth	4			
Indian Creek, W. Fork	source to mouth	5	COLD, SS	SCR	
*Medicine Lodge Creek	Edie Creek to Indian Creek	6	COLD, SS	PCR	DWS, SRW
Middle Creek Middle Creek	Dry Creek to mouth source to Dry Creek	7 8			
Dry Creek	source to mouth	9			
*Edie Creek	source to mouth	10	COLD, SS	SCR	
Medicine Lodge Creek	confluence of Warm and Fritz Creeks to Edie Creek	11	COLD, SS	PCR	DWS, SRW
*Irving Creek	source to mouth	12	COLD, SS	SCR	
Warm Creek	source to mouth	13	COLD, SS	SCR	
Divide Creek	source to mouth	14			
Horse Creek	source to mouth	15			
*Fritz Creek	source to mouth	16	COLD, SS	SCR	
Webber Creek	source to mouth	17	COLD, SS	SCR	
Deep Creek	source to mouth	18			
Blue Creek	source to mouth	19			
*Warm Springs Creek	source to mouth	20			
Crooked Creek	source to mouth	21			
Chandler Canyon		22			

Source: Idaho Administrative Code, IDAPA 58.01.02
*= 303 (d) listed streams
SS= Salmonid Spawning
PCR= Primary Contact Recreation
SCR= Secondary Contact Recreation
COLD= Cold Water Aquatic life
DWS= Domestic Water Supply
SRW= Special Resource Water

2.3 Summary and Analysis of Existing Water Quality Data

Past and existing water quality data was provided from the following agencies and/or organizations for the development of the Medicine Lodge Subbasin Assessment and TMDL. Data sources used in this section include: USGS, BLM, USFS, IASCD, SCC, and the IDF&G.

<u>Flow Characteristics</u>

The USGS station data discussed in section 1.1 is from the stations at Small, ID and Ellis Ranch. Figure 17 shows the average monthly discharge for Medicine Lodge Creek, station number 13116500 at Small, ID. This is averaged for the entire period of record, 1940-1969.

At gauging station number 13116500 at Small, ID, the annual mean flow for water years 1921-1999 is 63.3 cfs (cubic feet per second). Annual Runoff at this station typically peaks during the last few days of May or the first week of June. The highest flow recorded was on June 15, 1995 when flow reached 470 cfs. 1999 recorded the highest annual mean of 109 cfs. Minimum annual flows typically occur in early January when flow has been recorded as low as 10 cfs on March 15, 1944. The lowest annual mean was recorded in 1992 at 41.3 cfs. (USGS 1999)

Figure 18 shows the four periods of record for Medicine Lodge Creek, station number 13116500. Figure 19 – 22 breakout each of the four periods of record for data collected at station 113116500. Gaps in the hydrograph represent the years when data was not collected. This graph shows the severity of the storm events in the mid to late 1990s. The 1995, 1998 and 1999 water years were higher than any other water years on record. The period of high flow in 1995 caused the failure of several structures in the drainage and has left scars such as cut banks that can still be seen today.

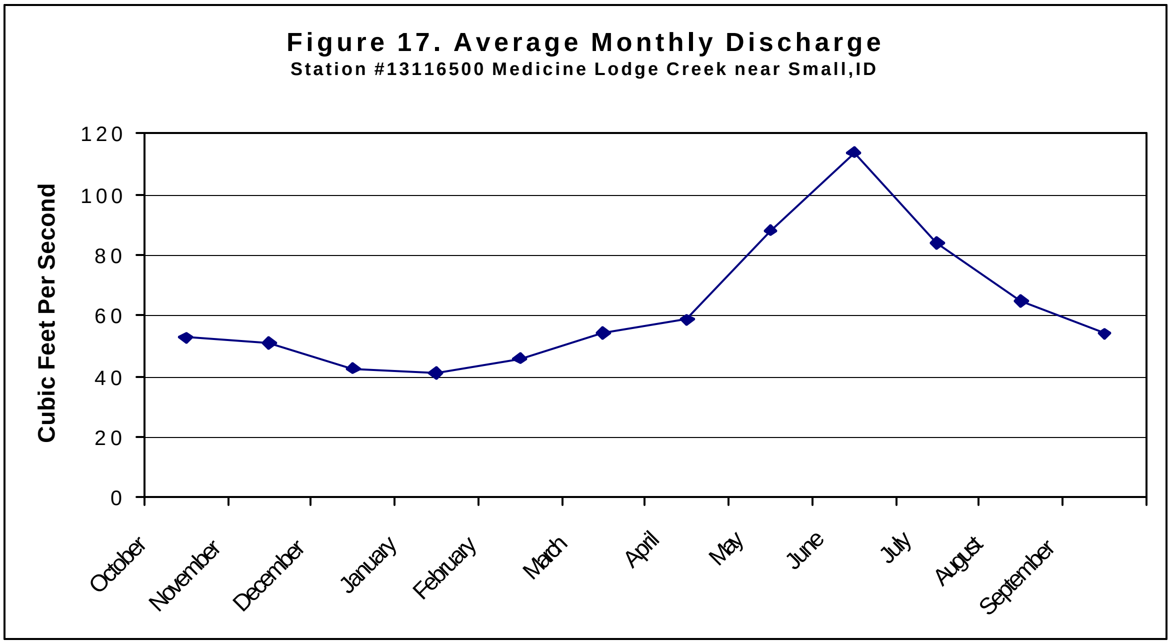
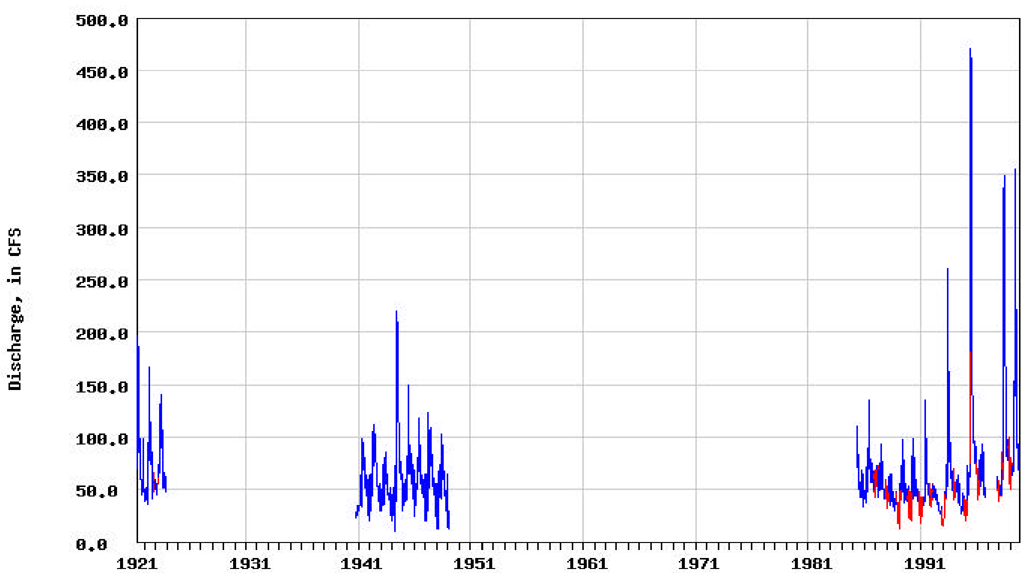
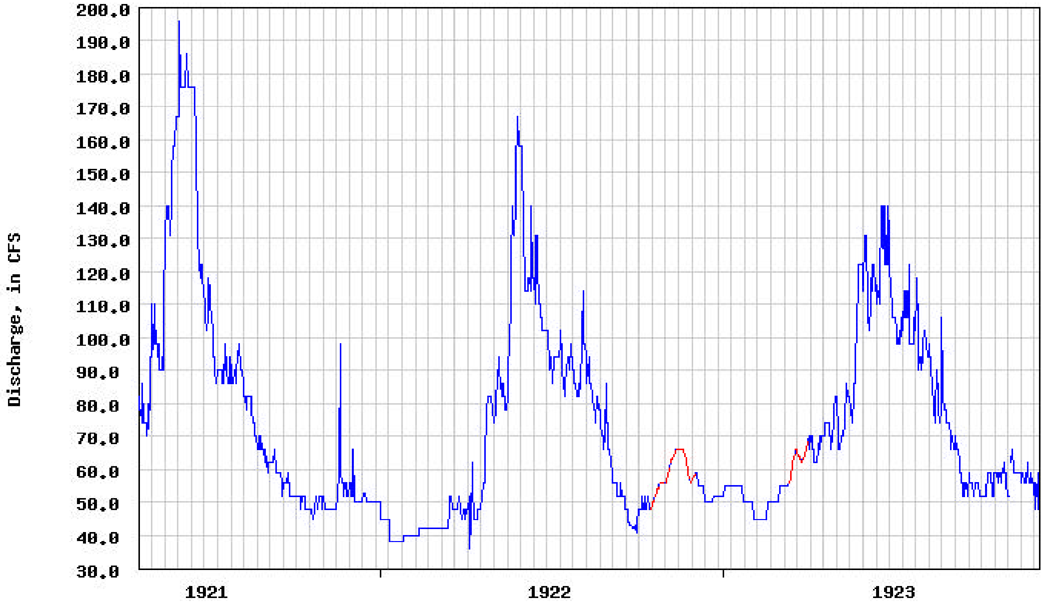


Figure 18. USGS historical daily values graph for Medicine Lodge Creek near Small, ID, station number 13116500, for dates 04/19/1921 through 10/30/1999



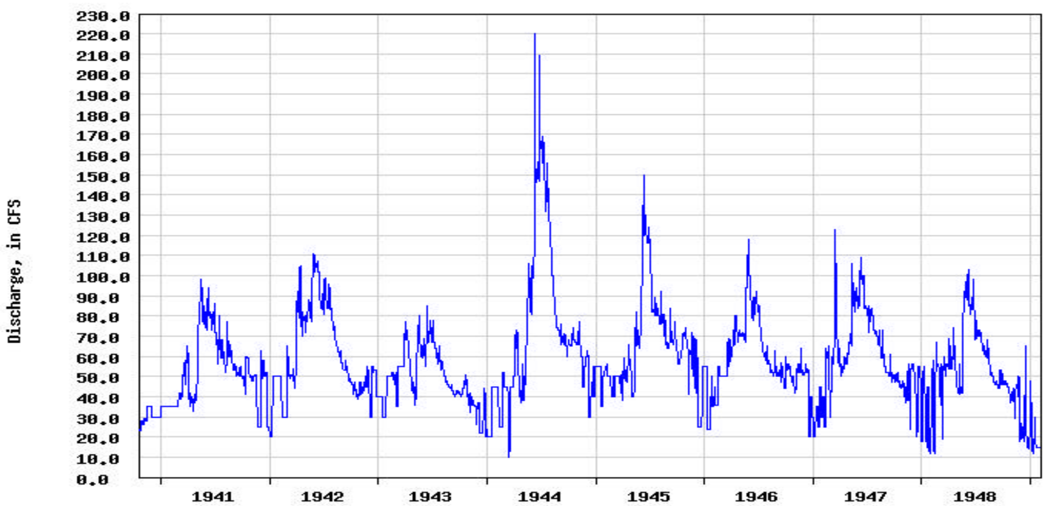
Source: *http://waterdata.usgs.gov/nwis-w/ID/index.cgi?statnum=13116500*

Figure 19. USGS historical streamflow daily values graph for *Medicine Lodge Creek near Small, ID,* station number 13116500, for dates 04/19/21 through 12/01/1923.



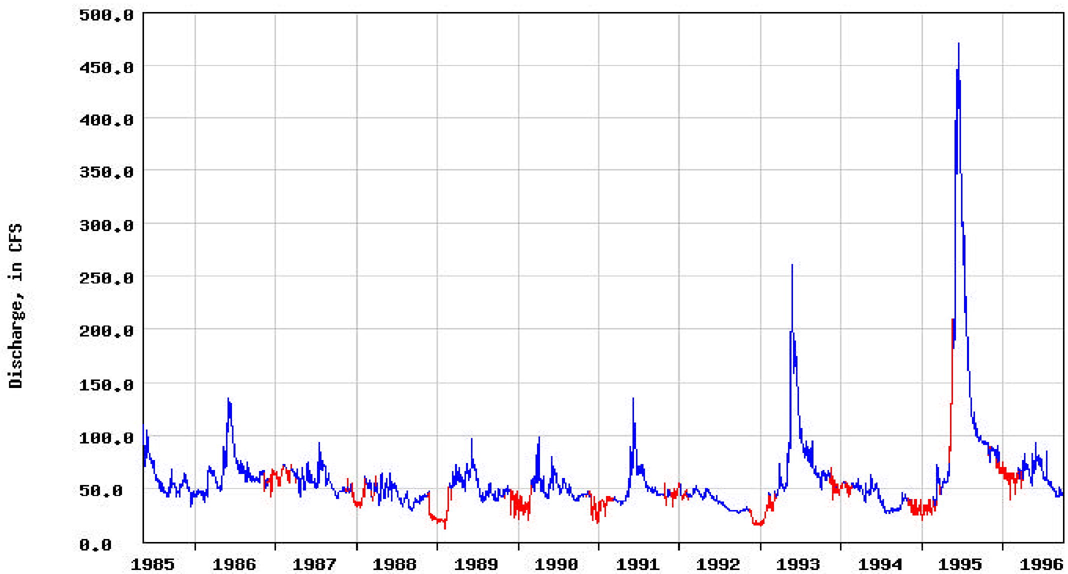
Source: http://waterdata.usgs.gov/nwis-w/ID/index.cgi?statnum=13116500.

Figure 20. USGS historical streamflow daily values graph for *Medicine Lodge Creek near Small, ID,* station number 13116500, for dates 10/18/1941 - 02/02/1949



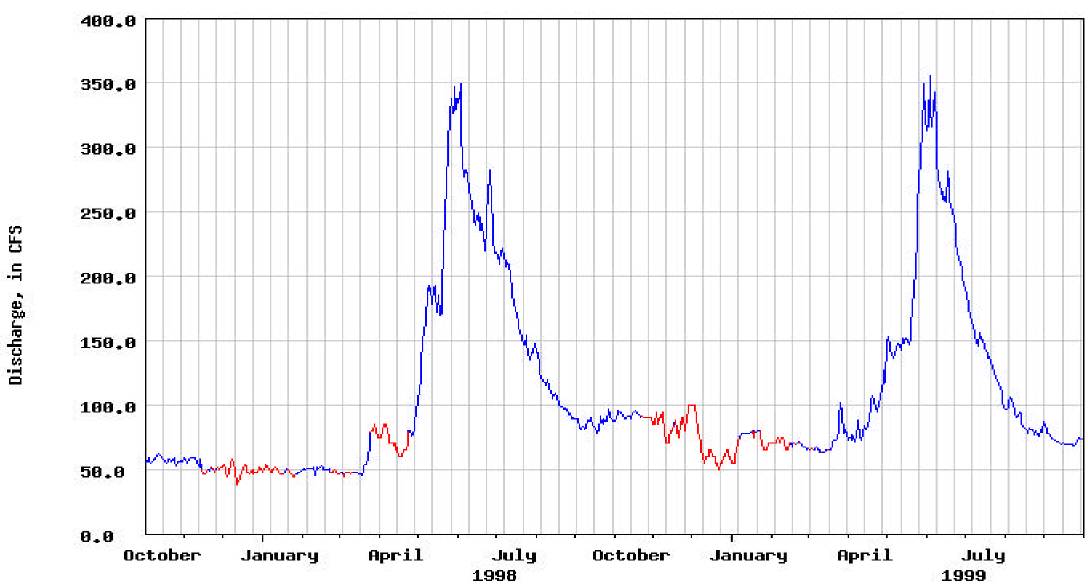
Source: http://waterdata.usgs.gov/nwis-w/ID/index.cgi?statnum=13116500.

Figure 21. USGS historical streamflow daily values graph for *Medicine Lodge Creek near Small, ID,* station number 13116500 for dates 05/07/1985 through 09/30/1996



Source: *http://waterdata.usgs.gov/nwis-w/ID/index.cgi?statnum=13116500*

Figure 22. USGS historical streamflow daily values graph for *Medicine Lodge Creek near Small, ID,* station number 13116500 for dates 10/01/1997 through 09/30/1999



Source: *http://waterdata.usgs.gov/nwis-w/ID/index.cgi?statnum=13116500*

Water Column Data

This section summarizes temperature data, surface fine sediment data, and depth fine sediment data collected on stream within the Medicine Lodge subbasin. Data for listed and non-listed streams are included in this section.

Stream Temperature Data

The DEQ, BLM and the USFS have collected stream temperature data in the Medicine Lodge drainage. The DEQ had twenty-two temperature sites on fourteen waterbodies during the summer of 2000. The USFS also put out two thermographs on two waterbodies during the 2000 season. The BLM sampled the area during the 1997 and 1998 seasons with seven sites on five waterbodies. Figure 23 shows the location of thermograph sampling sites.

For all of these sites, raw stream temperature was obtained and evaluated for the State of Idaho temperature criteria. These criteria are in two categories, cold water aquatic life and salmonid spawning. The temperature criteria for cold water aquatic life is 22?C (66.2?F) or less with a maximum daily average of no greater than 19?C (71.6?F). The criteria for salmonid spawning is 13?C (55.4?F) or less with a maximum daily average no greater than 9ºC (48.2ºF). [IDAPA 58.01.02.250.02] A major exceedance is when the criteria are exceeded 10% of the time or more or two exceedances in two separate 24-hour periods. See table 10-12 for temperature data exceedances on each site and thermograph locations for each stream.

The 1997-1998 temperature data collected by the BLM had a major exceedance of the salmonid spawning criteria on every stream that was sampled. There are no exceedances of the cold water aquatic life criteria. Most of the data collected in the year 2000 shows the same pattern. Both streams sampled by the USFS have major exceedances of the salmonid spawning criteria with no major exceedance of the cold water aquatic life criteria.

The DEQ data revealed major temperature criteria exceedances on several streams. Streams that exceed cold water aquatic life temperature criteria include Deep Creek and Warm Springs Creek. Data collected on Divide Creek was considered invalid since the reach was observed as dry during the sampling period. None of these streams are on the 303(d) list for temperature. Warm Springs Creek is fed by a naturally thermal spring. Upon review of temperature data for Warm Springs Creek, average daily stream temperatures remain fairly constant at 27ºC throughout the 98 days of data collected, showing that the stream is strongly influenced by the thermal spring entering Warm Springs Creek.

All of the streams sampled by the DEQ had a major exceedance of the salmonid spawning criteria. The data presented in Tables 10, 11, and 12 shows the number of days that water temperature exceeded salmonid spawning criteria temperatures.

However, this table is not representative of actual water quality standard exceedances. Specific salmonid spawning periods for fish species within this subbasin will be evaluated in Section 5 of this report. Stream temperatures in upper Webber Creek, which is a stream with little impact, had criteria exceedances of the salmonid spawning criteria during spawning periods at all three sampling locations. Edie Creek and Irving Creek , both 303(d) listed for nutrients, sediment, and habitat alteration but not for temperature, showed exceedances on all thermograph data collected, four sites on Irving Creek and three site on Edie Creek. The East Fork of Irving Creek had the fewest number of exceedances of the salmonid spawning criteria with six instantaneous measurement exceedances and eight daily average exceedances in the late spawning season for Yellowstone cutthroats and rainbow trout.

Medicine Lodge Creek and Fritz Creek are the only two streams on the 303(d) list for temperature. Medicine Lodge is listed from Spring Hollow to Small, ID while Fritz Creek is listed from the forks to the confluence of Medicine Lodge. In total, there were 4 temperature sites on the listed segment of Medicine Lodge Creek in the year 2000 and all showed a major exceedance of the salmonid spawning criteria. Fritz Creek had three temperature sites in 2000, and again, they all had a major exceedance of the salmonid spawning criteria.

Table 10. 2000 DEQ Temperature data and number of days where water temperatures exceeded the Salmonid Spawning Criteria during the entire monitoring period.

		Salmonid Spawning inst. 13? C			Salmonid Spawning daily average 9? C		
Stream Name	**WBID No.**	**Days**	**Max. # ?C Over**	**Max Date**	**Days**	**Max. # ?C Over**	**Max Date**
Crooked Creek	21	63	3.1	29-Jul	88	3.91	2-Aug
Deep Creek	18	103	12.3	5-Aug	101	9.43	2-Aug
Edie Creek, mouth	10	80	4.1	13-Jul	94	5.27	2-Aug
Edie Creek, at BLM boundary	10	89	5.1	1-Aug	94	4.51	1-Aug
Fritz Creek, mouth	16	97	5	13-Jul & 21-Jul	107	5.39	31-Jul
Fritz Creek, at forks	16	76	5.6	26-Jul	88	5.04	27-Jul
Horse Creek	15	104	6.7	23-Jun	113	6.17	13-Jul
Indian Creek	5	83	6.1	15-Jul	91	5.02	30-Jul
Irving Creek, mouth	12	82	6.1	30-Jun	98	4.99	24-Jun
Irving Creek, BLM boundary	12	95	7.4	9-Aug	92	4.98	5-Aug

		Salmonid Spawning inst. 13? C			Salmonid Spawning daily average 9? C		
Steam Name	WBID No.	Days	Max. # °C over	Max Date	Days	Max # °C Over	Max Date
Irving Creek, E. Fork	12	7	0.4	23-Jun, 24-Jun, & 30-Jun	35	0.68	1-Jul
Medicine Lodge Creek, at Small, ID	2	94	7.5	31-Jul	104	9.72	31-Jul
Medicine Lodge Creek, at Middle Cr.	6	92	6.8	2-Aug	103	8.62	31-Jul
Medicine Lodge Creek, below Spring Hollow	6	95	7.2	13-Jul & 22-Jul	101	7.61	2-Aug
Middle Creek, mouth	7	93	6.9	2-Aug	103	6.3	2-Aug
Middle Creek	7	102	8	1-Aug	106	7.7	2-Aug
Warm Creek	13	124	8	1-Aug	124	9.1	1-Aug
Warm Springs Creek	20	124	15.9	23-Aug	124	18.7	31-Jul
Webber Creek, mouth	17	89	5.6	13-Jul	97	5.2	2-Aug
Webber Creek, past USFS boundary	17	48	2.58	14-Jul	65	2.36	26-Jul
Webber Creek, past USFS boundary	17	44	2.43	14-Jul	61	2.09	26-Jul

Table 11. 1997-1998 BLM data, and Exceedances of the Salmonid Spawning Criteria

			Salmonid Spawning inst. 13 °C			Salmonid Spawning daily average 9 °C		
Stream Name	Description	WBID No.	Days	Max # °C Over	Max Date	Days	Max # °C Over	Max Date
Indian Creek	W. Fork, at USFS boundary	5	82	4.1	16-Jul, 21-Jul, 3-Aug	88	2.9	16-Jul
Edie Creek	3 mi. above MLC confluence	10	45	1.8	7-Jun, 15-Jul, 16-Jul	14	0.3	24-Jul
Irving Creek	3/4 mi. above MLC confluence	12	45	2.2	21-Jul	69	1.7	24-Jul
Warm Creek	At USFS boundary	13	137	7.7	21-Jul, 24-Jul	137	9.9	24-Jul
Horse Creek		15	97	2.8	19-Jun	128	3.8	24-Jul
Horse Creek	Lower	15	82	6.8	19-Jul	89	5.6	18-Jul
Horse Creek	Upper	15	0			80	1.4	18-Jul

Table 12. 2000 USFS data and Exceedances of the Salmonid Spawning Criteria

		Salmonid Spawning inst. 13° C			Salmonid Spawning daily average 9° C		
Stream Name	**WBID No.**	**Days**	**Max # °C Over**	**Max Date**	**Days**	**Max # °C Over**	**Max Date**
Medicine Lodge Creek	6	69	6.11	2-Aug	75	7.26	2-Aug
Fritz Creek	16	72	7.97	26-Jul, 9-Aug	68	5.16	26-Jul

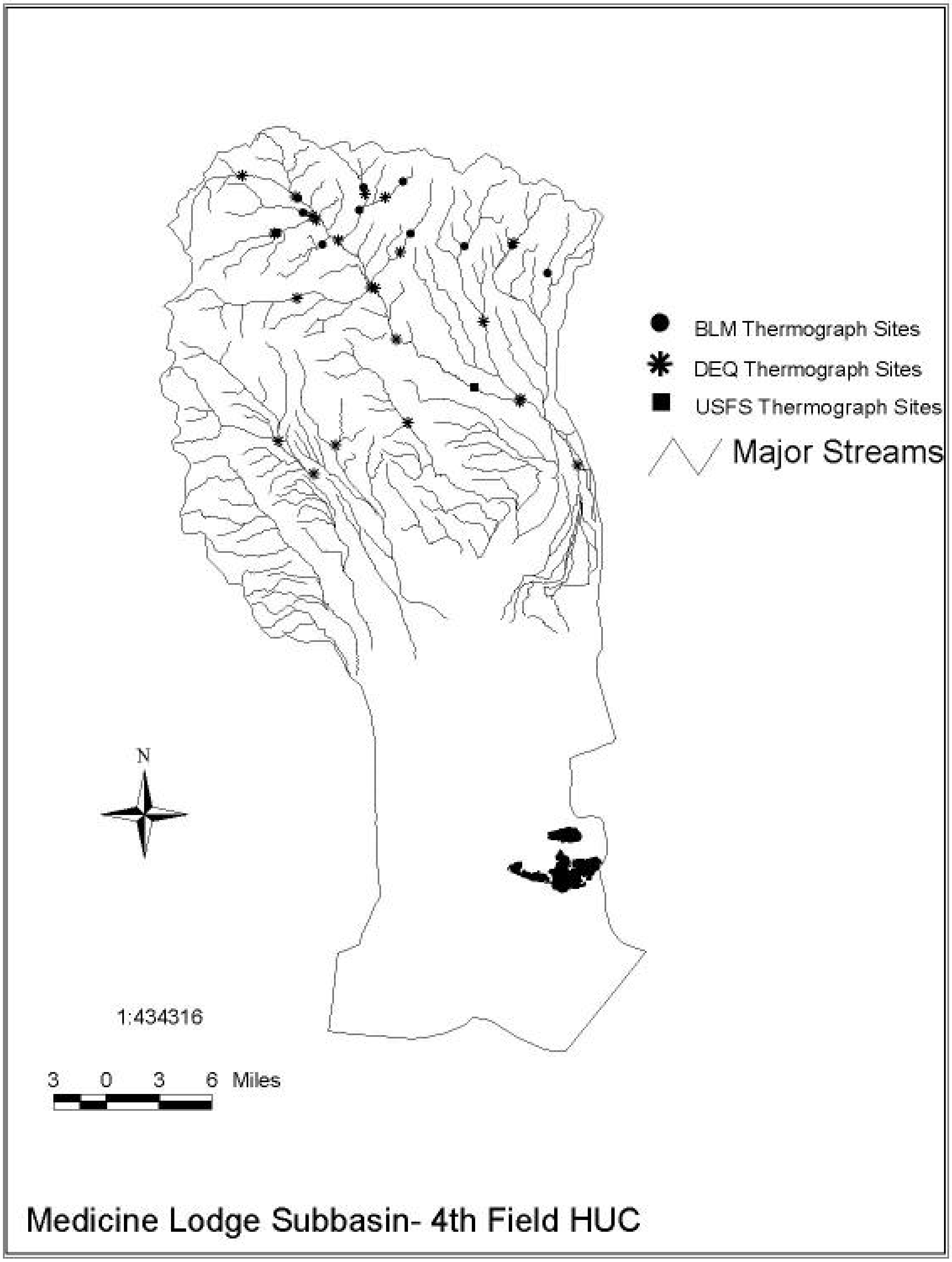


Figure 23. Thermograph Sampling Sites

Surface Fines

The DEQ has been collecting water quality data to assess stream health and collecting biological samples since 1993 through BURP. A Wolman pebble count is performed on each BURP site to estimate the particle size distribution of streambed sediment. These counts entail sampling at least 50 sediment particles per transect at each of three riffles per site. Counts are obtained from the bankfull width on each side, and so include the margins of the streambed which are not normally under water and may be more depositional than the main channel. A tally is kept of the size categories into which particles fall based on the intermediate axis diameter. From these data a percentage of particles less than a set category break can be determined, such as the percent surface fines less than 6 mm (small gravel and finer) (DEQ 1998).

A size of 6 mm is often used because many salmonid species prefer particles of this size or greater for spawning and spawning success is diminished when the proportion of finer materials becomes too great. Many researchers have reported a negative correlation between percent fines and salmonid egg survival or aelvin emergence, but no threshold has been accepted. Salmonid egg survival or aelvin emergence seems to be negatively related to the proportion (in the range of 0-50%) of fines below a particle size of 0.8 to 9.5 mm in diameter (intermediate axis) (DEQ 1998).

Surface fines values and the related data is summarized in Table 13 with sample locations shown in Figure 24. There is a large amount of variability in these streams and there is very little difference between the average for the 303(d) listed streams and the total average. The average percent fines for non-listed streams is actually higher than the average for the listed streams, but the banks are much more stable. Almost half (42%) of the streams have surface fines percentages of over 50%. Indian Creek, Webber Creek and Irving Creek all have fairly low surface fines percentages. Edie Creek appeared to have a moderately low percentage of surface fines but, there is an overall increasing trend in percentage fines in the lower section of the watershed. Crooked Creek, the North Fork of Fritz Creek, Horse Creek and Warm Springs Creek all have high surface fines percentages although the banks appeared to be fairly stable.

Table 13. DEQ Sediment Data

Stream	WBID	Year	Elev. (ft)	Rosgen Channel Type	% Depth Fines <6 mm	% Stable		% Covered	
						Left Bank	Right Bank	Left Bank	Right Bank
Corral Creek	4	96	8200	B	54	100	100	94	73
Crooked Creek	21	97	6420	G	84	100	100	50	50
Deep Creek	18	98	5970	B	60	88	100	88	100
Divide Creek	14	97	7160	B	66	100	100	100	100
Dry Creek	9	98	6540	C	37	93	73	94	77
Edie Creek	10	94	7440	B	12	40	20	100	90
	10	94	6260		55	35	30	85	80
	10	95	7500	B	39	90	5	100	95
	10	95	6280	B	69	100	100	100	100
Fritz Creek	16	94	6930	B	38	40	70	90	100
	16	95	6930	B	65	95	95	100	100
	16	94	6520	B	41	35	40	100	100
	16	95	6496	F	54	100	100	100	100
Fritz Creek, N. Fork	16	98	7070	B	83	100	100	100	63
Fritz Creek, S. Fork	16	98	7200	B	55	84	100	84	85
Horse Creek	15	98	7190	F	45	82	85	88	83
	15	97	6550	G	85	98	100	100	100
Indian Creek	3	98	5530	F	13	91	100	87	97
Indian Creek W. Fork	5	98	7390	A	21	57	88	75	79
	5	98	7080	B	34	13	13	99	76
Irving Creek	12	98	7070	C	39	40	20	64	64
	12	95	7040	C	29	60	5	80	20
	12	94	7040	A	5	50	50	70	85
	12	94	6460	C	24	60	70	100	100
	12	95	6400	C	30	100	100	100	100

Stream	WBID	Year	Elev. (ft)	Rosgen Channel Type	% Depth Fines <6 mm	% Stable		% Covered	
						Left Bank	Right Bank	Left Bank	Right Bank
Irving Creek E. Fork	12	98	6960	B	49	93	94	85	98
Medicine Lodge Creek	11	97	6460	F	51	90	88	90	90
	6	94	6200	C	14	80	90	90	100
	6	94	5700	B	20	40	60	75	65
	2	94	5240	B	14	55	80	55	45
Middle Creek	8	98	6790	A	21	33	14	45	37
	7	97	5720	C	43	100	100	100	100
Myers Creek	21	97	6420	B	63	100	99	100	99
Warm Creek	13	95	6576	B	57	90	5	100	100
	13	94	6540	B	43	50	50	85	80
	13	95	6808	B	67	95	90	100	100
Warm Springs Creek	20	94	6640		43	70	60	100	100
	20	95	6600	F	83	100	100	100	100
	20	95	5335	E	100	70	35	100	90
Webber Creek	17	98	6871	B	39	99	100	34	87
	17	98	6380	B	25	100	99	99	96
	17	97	6560	B	42	94	100	100	100
Wood Canyon Creek	8	98	6720	A	74	59	59	59	59
Mean for 303(d) listed streams					41	66	59	90	86
Mean for Non-listed streams					53	87	89	89	88
Total Mean					47	78	75	90	87

% Fines based on Wolman Pebble count of minimum 50 particles at three transects

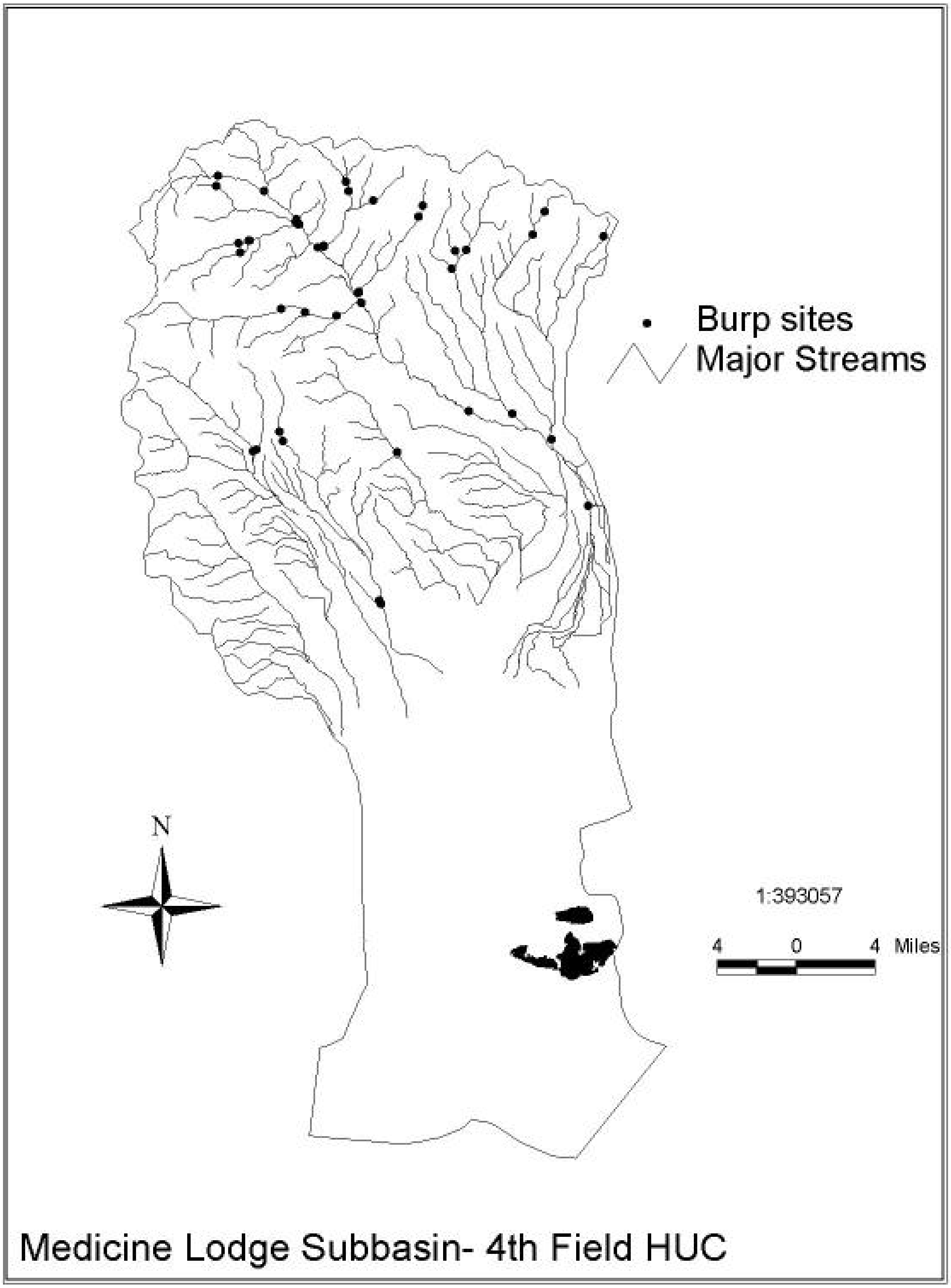


Figure 24. DEQ BURP Sites

Depth Fines

In late August and early September of 2000, the DEQ collected McNeil sediment core samples at 10 locations throughout the subbasin. 11 more sites were sampled in 2001. Sediment core data evaluates subsurface fine sediment to a depth of 4 in. Since surface fines can easily be swept away by spawning fish, the core samples are considered to be more biologically meaningful. The percentage of intragravel fines less than 6.35 mm is correlated with expected fry survival. Most of the sites collected were in areas with characteristics which meet salmonid spawning criteria, however there were additional data sites collected to help characterize the subbasin. Salmonid spawning sites are in bold print in Table 14 while the additional sites are in plain text.

The approximate locations of the depth fines sites are shown in Figure 25. The cumulative percentage for each depth fines site are shown in Appendix D. Any material greater than 2.5 inches has been excluded. Single repetitions were done on most of the sites in 2000, however three repetitions were done on Warm Springs Creek, Medicine Lodge Creek at Small, ID, Irving Creek, and Edie Creek. Three repetitions were performed on all of the sites in 2001. For the sites with three repetitions, the cumulative percentages were averaged.

Table 14 shows the percentage of fine material (less than 6.35 mm) for each of the sites. The DEQ has adopted a target level of 28% or less of fine particles less than 6.35 mm based on studies done by the Forest Service. The majority of the streams in the Medicine Lodge Subbasin do not meet this goal. Webber Creek, Deep Creek and Warm Springs Creek are the only streams with 28% of fine material or less and Medicine Lodge Creek at Small, ID was not much above the goal. The mid-section of Medicine Lodge Creek had the highest amount of fine material with >66% of the sample being smaller than 6.35 mm. Webber Creek, which has the least amount of human impact in the watershed, had between 20.77% and 48.37%, indicating that the watershed is naturally slightly erosive.

Table 14. Depth Fines

Stream	WBID No.	Date of data collection	Location	Location Description	% of fine material < 6.35mm
Medicine Lodge Creek	2	8/30/00	N 44º 13.048’ W 112º 22.514’	At Small, ID	32.73
Medicine Lodge Creek	**6**	**8/29/00**	**N 44º 18.745’ W 112º 33.188’**	**Mid-section**	**66.47**
Middle Creek	7	8/30/00	**N 44º 16.886’** W 112º 26.648’	Up MLC road on State land	47.49
Middle Creek	**8**	**7/11/01**	**N 44º 24’ 19.53” W 112º 29’ 49.95”**	**High on USFS land**	**23.54**

Table 14. Continued

Stream	WBID No.	Date of data collection	Location	Location Description	% of fine material < 6.35mm
Edie Creek	**10**	**8/29/00**	**N 44º 23.735' W 112º 34.531'**	**Just past BLM boundary**	**37.41**
Edie Creek	**10**	**5/8/01**	**N 44º 23.369' W 112º 35.296'**	**1.1 mi. up Edie Creek Road**	**54.65**
Edie Creek	**10**	**4/29/01**	**N 44º 23.714' W 112º 34.551'**	**Just past BLM boundary**	**36.83**
Irving Creek	**12**	**8/29/00**	**N 44º 25.984' W 112º 37.107'**	**Below forks**	**45.65**
Irving Creek	12	5/2/01	N 44º 24.585' W 112º 38.533'	Mouth	40.06
Irving Creek	**12**	**4/30/01**	**N 44º 23.735' W 112º 34.531'**	**East Fork on BLM**	**24.61**
Irving Creek	**12**	**5/1/01**	**N 44º 26.820' W 112º 36.731'**	**Just past BLM boundary**	**25.33**
Irving Creek	**12**	**7/10/01**	**N 44º 27' 41.18" W 112º 37' 06.79"**	**High on USFS land**	**50.50**
Warm Creek	**13**	**7/10/01**	**N 44º 25' 43.21" W 112º 39' 59.14"**	**Just above Horse Creek**	**50.99**
Fritz Creek	**16**	**8/29/00**	**N 44º 25.237' W 112º 41.782'**	**Just below forks**	**39.88**
Webber Creek	**17**	**8/29/00**	**N 44º 21.813' W 112º 39.655'**	**Just past USFS boundary**	**24.62**
Webber Creek	**17**	**5/8/01**	**N 44º 21.648' W 112º 39.368'**	**At bridge**	**48.37**
Webber Creek	**17**	**5/9/01**	**N 44º 21.812' W 112º 41.272'**	**At campground**	**27.35**
Webber Creek	**17**	**5/9/01**	**N 44º 22.219' W 112º 36.348'**	**Mouth**	**20.77**
Deep Creek	**18**	**9/5/00**	**N 44º 15.343' W 112º 33.937'**	**mid-section at road crossing**	**15.99**
Warm Springs Creek	20	9/5/00	N 44º 12.143' W 112º 37.519'	Road crossing at Maud Mtn.	28.06
Crooked Creek	**20**	**9/5/00**	**N 44º 13.266' W 112º 41.111'**	**Lower section**	**39.83**

*** Bold type indicates that the sample was taken in salmonid spawning habitat. Additional data sites were collected to aid in characterization of subbasin.**

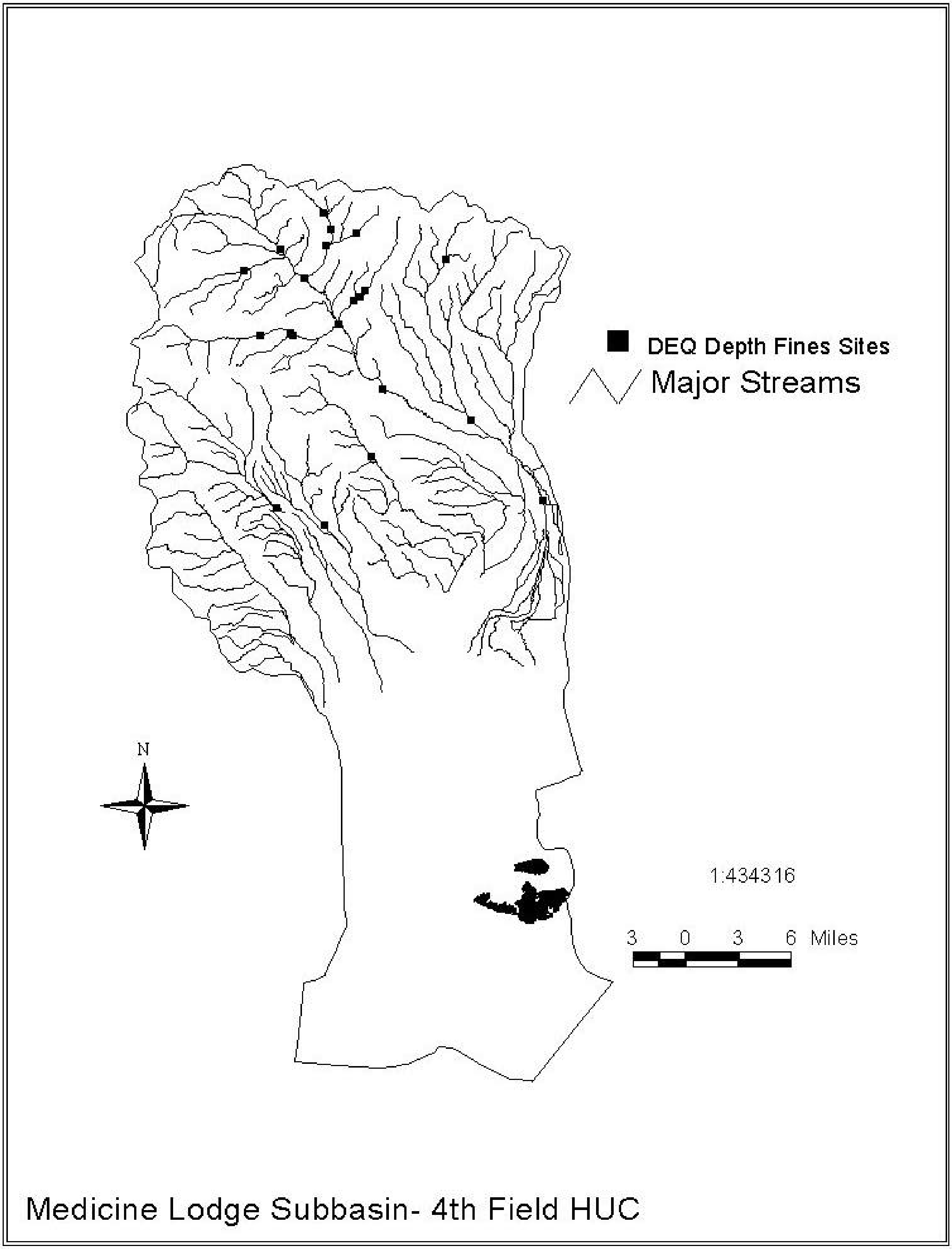


Figure 25. Depth Fine Sites

Biological and Other Data

This section summarizes fish summary data, and stream bank assessment data collected within the subbasin. Data sources include the BLM, USFS, IASCD, and DEQ.

Fish Data Summary

Fish distribution and age classes are important documentation of the existence and status of the fish in the subbasin. Electrofishing data were collected by the DEQ, BLM, USFS and the Idaho Department of Fish and Game (IDFG). Age distribution was derived from the DEQ and BLM data, documenting the status of the aquatic life present. All of the streams in the subbasin are considered to meet the beneficial use of Cold Water Aquatic Life, and seven streams have designated beneficial uses including Salmonid Spawning.

Table 15 shows the distribution and age groups of salmonids throughout the basin, based on the information from DEQ and BLM. This data was placed together due to its consistency and completeness. The table is organized by water body identification number. The entries in the Yellowstone cutthroat, rainbow and brook trout columns indicates the number of age classes documented from the fish collected. The “J” indicates that juveniles were also documented.

The IDFG data (Table 15) and USFS data (Table 16) are shown separately due to the fact that the length distribution of the fish was not recorded. It is important to note, however, that although the age groups cannot be identified, the presence of species can. The USFS data shows the presence of Yellowstone Cutthroat in several streams where other data do not. These streams include Corral Creek, Crooked Creek, Divide Creek, the North Fork of Fritz Creek, and Webber Creek. Idaho Department of Fish and Game also found Yellowstone Cutthroat on Webber Creek although DEQ electrofishing did not.

Cold water species dominate the Medicine Lodge subbasin. Warm Springs Creek, fed from the Warm Springs, is the only stream where warm water species, non-native species of fish have been documented. Figure 26 displays the location of IDEQ and BLM fish sampling sites in the Medicine Lodge Subbasin.

Table 15. Occurrence of fish and number of salmonid age classes in the Medicine Lodge Subbasin

Creek Name	WBID No.	YCT	BRK	RBT	Non-salmonids	Comments	Data source	Date collected
Medicine Lodge Creek	2					no fish	IDEQ	Jul-99
Indian Creek	3			1			IDEQ	Jul-98
Indian Creek, E. Fork	4	3/J		5/J		hybrids	BLM	Oct-97
Indian Creek, W. Fork	5	3/J				hybrids	BLM	Sep-97
Indian Creek, W. Fork	5	3					IDEQ	Jul-98
Indian Creek, W. Fork	5	1			shorthead sculpin		IDEQ	Jul-98
Medicine Lodge Creek	6			2/J	shorthead sculpin		IDEQ	Sep-97
Medicine Lodge Creek	6			1/J	shorthead sculpin		IDEQ	Sep-97
Medicine Lodge Creek	6			1	shorthead sculpin		IDEQ	Sep-97
Medicine Lodge Creek	6			2	shorthead sculpin		IDEQ	Sep-97
Medicine Lodge Creek	6			4/J		hybrids	BLM	Sep-00
Middle Creek	7			1	shorthead sculpin		IDEQ	Sep-97
Middle Creek	8	3/J		4/J		hybrids	BLM	Sep-97
Wood Canyon Creek	8					no fish	IDEQ	Jul-99
Dry Creek	9			4			IDEQ	Jul-99
Edie Creek	10		2/J				BLM	Sep-97
Edie Creek	10		2		shorthead sculpin		IDEQ	Sep-97
Cold Creek	11		2/J	3/J	shorthead sculpin		BLM	Sep-99
Medicine Lodge Creek	11			3	shorthead sculpin		IDEQ	Sep-97
Medicine Lodge Creek	11			5/J		hybrids	BLM	Sep-00
Middle Creek	8					no fish	IDEQ	Jul-98
Irving Creek, E. Fork	12	1	2/J			hybrids	BLM	Sep-99
Irving Creek	12		2/J	5/J		hybrids	BLM	Sep-97
Irving Creek, W. Fork	12	3/J	2/J	3/J			BLM	Sep-97
Irving Creek	12			2	Shorthead sculpin		IDEQ	Sep-97
Irving Creek	12	2		2	Shorthead sculpin		IDEQ	Sep-99

Table 15. Continued

Creek Name	WBID No.	YCT	BRK	RBT	Non-salmonids	Comments	Data source	Date collected
Irving Creek, E. Fork	12		2				IDEQ	Jul-98
Irving Creek	12	2			Shorthead sculpin		IDEQ	Jul-98
Warm Creek	13			4/J			BLM	Sep-97
Warm Creek	13			3	Shorthead sculpin		IDEQ	Sep-97
Divide Creek	14					no fish	IDEQ	Sep-97
Horse Creek	15		2/J	3/J		hybrids	BLM	Sep-97
Horse Creek	15			3	Shorthead sculpin		IDEQ	Sep-97
Horse Creek	15					no fish	IDEQ	Jul-98
Fritz Creek	16					no fish	IDEQ	Sep-97
Fritz Creek, S. Fork	16					no fish	IDEQ	Jul-98
Fritz Creek, N. Fork	16					no fish	IDEQ	Jul-98
Webber Creek	17			4	Shorthead sculpin		IDEQ	Sep-97
Webber Creek	17					no fish	IDEQ	Jul-98
Webber Creek	17		1	1			IDEQ	Aug-00
Deep Creek	18					no fish	IDEQ	Jul-99
Myers Creek	21					no fish	IDEQ	Sep-97
Crooked Creek	22					no fish	IDEQ	Sep-97
Crooked Creek	22					no fish	IDEQ	Aug-00

YCT = Yellowstone cutthroat; BRK = Brook Trout; RBT = Rainbow Trout; J = Juvenile

Table 16. Idaho Department of Fish and Game Fish Summary

Creek Name	WBID No.	Species Composition (%)				Sampling Date	Comments
		YCT	BRK	RBT	YCT X RBT		
Irving Creek, E. Fork	12	15	77	0	8	Jun-87	YCT ripe
Irving Creek	12	70	15	8	8	Jun-87	YCT ripe
Fritz Creek	16	79	0	4	14	May-87	YCT YOY present
Webber Creek	17	5	67	26	2	Jun-87	BRK YOY present
Warm Creek	13	0	0	100	0	May-87	RBT YOY present
Warm Creek	13	0	0	99	1	May-87	RBT ripe or spent
Indian Creek	3	0	0	94	6	Jun-87	
Indian Creek	3	0	0	95	5	Jun-87	
Indian Creek, W. Fork	5	100	0	0	0	Jun-87	No fry; 1 ripe YCT
Medicine Lodge Creek	6	0	0	100	0	Jun-87	
Medicine Lodge Creek	6	1	0	97	2	Jun-87	Fish > or = 150 mm
Medicine Lodge Creek	6	8	0	82	10	Jun-87	Fish > or = 150 mm

YCT = Yellowstone cutthroat; BRK = Brook trout; RBT = Rainbow trout; YOY = Young of the year

Table 17. U.S. Forest Service Fish Summary

Creek Name	WBID No.	Date	YCT	BRT	RBT	YCT x RBT hybrids	Shot-headed Sculpin present
Corral Creek	4	07/23/1997	47		6	1	
Indian Creek, W. Fork	5	07/17/1997	85	1		1	*
Middle Creek	8	07/21/1997	55		8	3	
Irving Creek	12	07/21/1997	16	5	5	3	*
Divide Creek	14	09/29/1997	0	2	88	4	
Fritz Creek, N. Fork	16	07/22/1997	3		1	12	
Webber Creek	17	07/09/1997	25	12	5	8	*
Crooked Creek	21	07/03/1997	19	1			

YCT = Yellowstone cutthroat; BRT = Brook trout; RBT = Rainbow trout

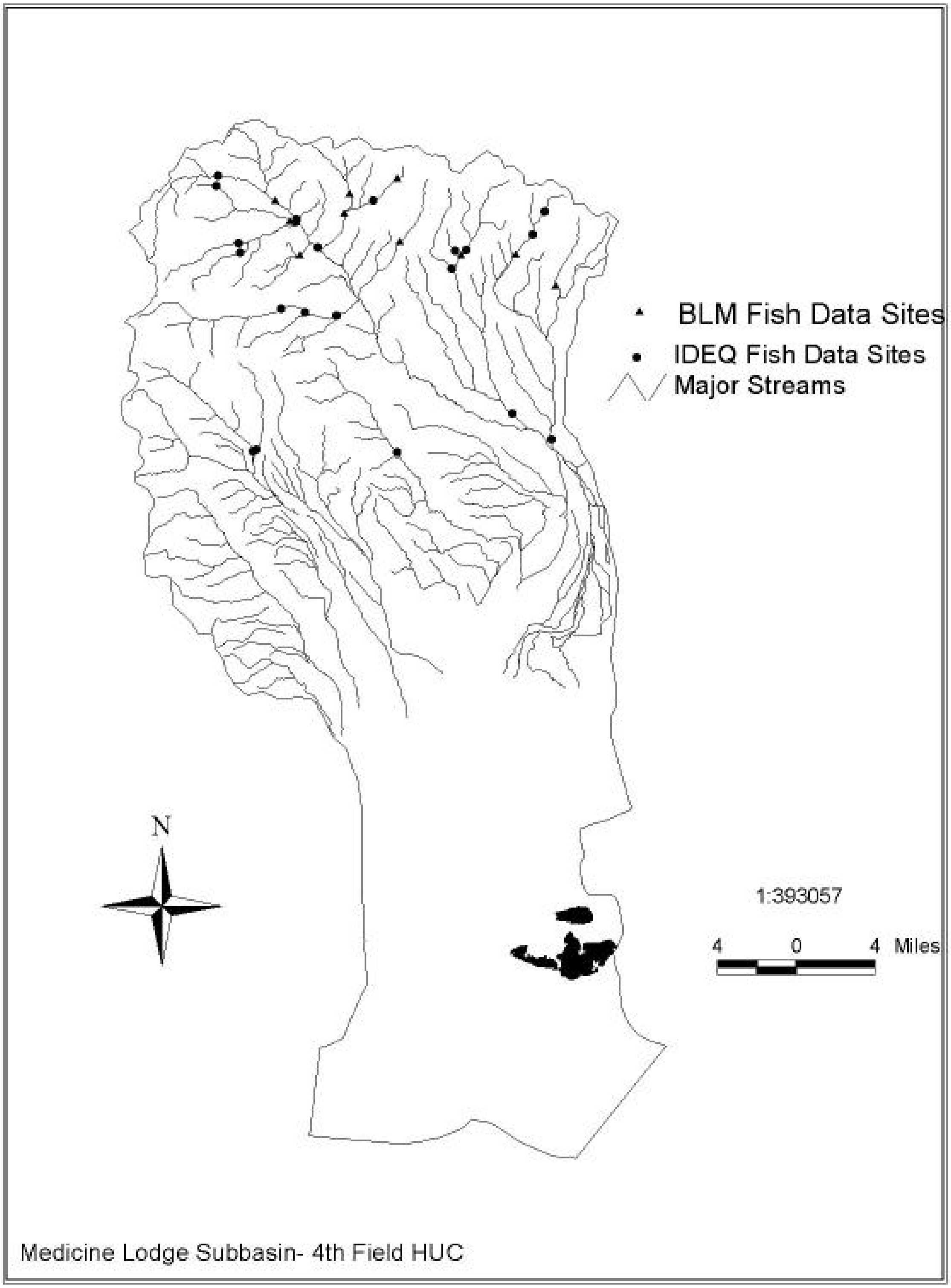


Figure 26. IDEQ and BLM Fish Sampling Sites

Stream Bank Assessments

The Idaho Association of Soil Conservation Districts (IASCD) and Soil Conservation Commission (SCC) in cooperation with the Natural Resources Conservation Service (NRCS), conducted a complete stream bank assessment on private land on four of the 1998 303(d) listed streams in Medicine Lodge. The protocols followed included Stream Visual Assessment Protocol (SVAP), Proper Functioning Condition (PFC), and a streambank erosion condition inventory (SECI) worksheet.

SVAP is a protocol that allows an interdisciplinary team of three or more people to assign a score for each reach in different categories. The categories scored include: channel condition, hydrologic alteration, riparian zone, bank stability, water appearance (clarity), nutrient enrichment, barriers to fish movement, instream fish cover, pools, macroinvertebrate presence and habitat, riffle embeddedness and the presence of manure. Each of these categories is given a score from a range of numbers. The scores are then added to give the reach a grade of poor, fair, good or excellent.

PFC is a technique that is primarily used to determine which stream reaches are at greater risk. This allows land managers to prioritize their efforts and determine which areas need to be looked at closer. PFC protocol requires an interdisciplinary team of three or more people to walk a reach and then answer a series of questions about the hydrologic, vegetative and soil erosion on the reach. The answers then determine if the reach is in properly functioning condition (PFC), functional at risk (FAR), or nonfunctional (NF). Within each of these three categories, the team determines if it is in the high, medium or low range and if the trend is upward or downward.

The SECI worksheet also gives a score to different factors of the reach. These include: bank stability, bank condition, vegetative cover, channel shape, substrate, and deposition. The scores determine if the reach has slight, moderate or severe erosion problems. The eroding segments of the stream reach are also measured in length and width and recorded.

Irving Creek, Edie Creek, Fritz Creek and Medicine Lodge Creek were all assessed in this process. Irving Creek was separated into four reach segments, two located from the forks to the confluence with Medicine Lodge Creek and one on each fork. The total length of stream assessed was 4.2 miles and of that 0.6 miles were actively eroding banks. The estimated amount of sediment eroding from this stream, based on this survey, is approximately 223 tons/mile/year. The entire stream was determined to be functional at risk with the lowest reach being non-functional. Most of the non-eroding banks along the stream had only slight erosion problems, but the banks that were eroding are classified as severe. These eroding banks are the main reason that the stream is primarily classified as functioning at risk. Although many of the banks are developing new flood plains and are in a state of repair, it is unlikely that a large flooding event could pass through this creek without major devastation (Table 18).

Edie Creek was separated into three reaches along the private property for a total of 2.6 miles included in the assessment. The estimated amount of sediment eroding from this stream, based on this survey, is approximately 56 tons/mile/year. Edie Creek was determined to be in properly functioning condition with slight to moderate erosion problems. All three segments received a fair SVAP score (Table 19).

Fritz Creek was separated into four different reaches totaling 2.2 miles of stream assessed. This was a continuous assessment from the U.S. Forest Service boundary (0.27 miles below the forks) to the confluence with Medicine Lodge Creek. The lowest segment was determined to be FAR, but the rest of the stream was rated as PFC. Fritz Creek was determined to have only slight erosion problems according to the SECI worksheet, and all but one reach was given a Fair rating under SVAP. The estimated sediment load from the stream assessed is 25.4 tons of sediment/mile/year (Table 20).

Medicine Lodge Creek was assessed from the confluence of Fritz and Warm Creek down to Small, ID, totaling almost 29 river miles. Several small segments of stream located on BLM land was excluded from the survey. A summary of the data collected is located in Table 21. SECI scores were divided between the segments of stream which were eroding and non-eroding. Most of the non-eroding banks had a slight to moderate erosion problem, while the eroding banks were primarily seen to have severe erosion problems. The estimated erosion rate based on this survey is 1,765 tons of sediment/mile/year.

The data presented shows the dramatic difference in erosion rates between these listed streams. Medicine Lodge Creek has the most severe erosion problems, and is the largest stream in the subbasin with the most hydrologic power. Of the tributaries, Irving Creek has the highest rate of erosion.

The BLM also conducted riparian assessment evaluations in Medicine Lodge from 1993 through 2000. This primarily consisted of the PFC protocol (see Table 22). Of the streams on the 1998 303(d) list, Edie Creek and Medicine Lodge Creek were rated as functional at risk while Warm Springs Creek and Irving Creek were rated as nonfunctional.

Table 18. IASCD Irving Creek Streambank Assessment Summary

Reach	WBID	Reach Length (mi)	Reach Slope (%)	Reach Drainage (mi²)	PFC Range	SVAP	SECI	Tons/ Year	Tons/mile/ year
I1	12	2.3	2.1	21	NF	Poor	Slight/ Moderate	361	156.96
I2	12	0.5	2.1	16.4	FAR	Good	Slight/ Severe	72	144.00
IW	12	1	4.3	5.2	FAR	Poor	Slight/ Severe	522	522.00
IE	12	0.9	2.7	6	FAR	Fair	Slight/ Severe	94	104.44
Total		**4.7**						**1049**	**223.19**

Table 19. IASCD Edie Creek Streambank Assessment Summary

Reach	WBID	Reach Length (mi)	Reach Slope (%)	Reach Drainage (mi²)	PFC Range	SVAP	SECI	Tons/ Year	Tons/mile/ year
E1	10	0.5	1.3	10.8	PFC	Fair	Slight	10.8	21.6
E2	10	1.6	3.7	9.7	PFC	Fair	Moderate	83.8	52.38
E3	10	0.6	4	7.3	PFC	Fair	Moderate	56.7	94.5
Total		**2.7**						**151.3**	**56.04**

Table 20. IASCD Fritz Creek Streambank Assessment Summary

Reach	WBID	Reach Length (mi)	Reach Slope (%)	Reach Drainage (mi²)	PFC Range	SVAP	SECI	Tons/ Year	Tons/mile/ year
F1	16	0.3	1.6	18.2	FAR	Fair	Slight	6	20
F2	16	0.6	4.4	17.8	PFC	Fair	Slight	20	33.333
F3	16	0.8	0.2	17.5	PFC	Poor	Slight	19	23.75
F4	16	0.5	1.1	13.9	PFC	Fair	Slight	11	22
Total		**2.2**						**56**	**25.45**

Table 21. IASCD Medicine Lodge Creek Streambank Assessment Summary

Reach	WBID	Reach Length (mi)	Reach Slope	Reach Drainage (mi^2)	PFC Range	SVAP	SECI	Tons/ Year	Tons/mile /year
MLC 1	2	1.8	1.3	251.7	FAR/ High	Poor	Slight/ moderate	100	55.6
MLC 2	2	1.8	1.1	251.4	PFC/ Mid	Fair	Slight/ moderate	81	45
MLC 3	2	0.45	3	250.9	FAR/ Mid	Poor	Severe	157	348.9
MLC 4	6	1.15	1	250.8	PFC/ Mid	Fair	Slight	63	54.8
MLC 5	6	0.7	1.1	200	FAR/ Mid	Fair	Slight	10	14.3
MLC 6	6	1.33	1	152.3	PFC/ Mid	Fair	Moderate	89	66.9
MLC 7	6	1.7	0.8	151.6	FAR/ High	Fair	Slight/ severe	146	85.9
MLC 8	6	1.49	1.1	150.4	PFC/ High	Good	Slight/ moderate	34	22.8
MLC 9	6	1.3	1	149.1	FAR/ Mid	Poor	Moderate/ severe	269	206.9
MLC 10	6	0.2	0	148				0	0
MLC 11	6	1.6	1	148	FAR/ Mid	Good	Slight/ severe	103	64.4
MLC 12	6	1.72	1.1	145.3	PFC/ Mid	Good	Slight/ moderate	62	36
MLC 13	6	1	1	144	PFC/ Low	Fair	Slight/ severe	72	72
MLC 14	6	1.8	1	141	FAR/ Mid	Fair	Slight/ severe	217	120.6
MLC 15	6	2.3	1.3	136.2	PFC/ Low	Good	Slight/ severe	93	40.4
MLC 16	11	1.59	3	120	FAR/ High	Fair	Slight/ severe	117	73.6
MLC 17	11	1.6	1	89.2	NF/ Mid	Poor	Moderate/ severe	302	188.8
MLC 18	11	1.3	2.2	86.5	FAR/ Mid	Fair	Slight/ severe	124	95.4
MLC 19	11	0.65	1.3	64.7	FAR/ High	Fair	Slight/ moderate	28	43.1

Table 21 Continued									
Reach	**WBID**	**Reach Length (mi)**	**Reach Slope**	**Reach Drainage (mi^2)**	**PFC Range**	**SVAP**	**SECI**	**Tons/ Year**	**Tons/mile /year**
MLC 20	11	0.7	0	64.3	PFC/ Mid	Good	Moderate	18	25.7
MLC 21	11	1	2	56.5	PFC/ Low	Fair	Slight	17	17
MLC 22	13	1.5	1.7	38.5	PFC/ Mid	Fair	Moderate	41	27.3
MLC 23	13	0.2	3.2	25.3	FAR/ Mid	Poor	Moderate	12	60
Total		**28.88**						**2155**	**74.62**

Table 22. BLM Summary of Medicine Lodge Stream Riparian Condition (1993-2000)

Stream	WBID	Rosgen Channel Type	Health	Trend	Miles
Black Canyon Creek	13	NA	PFC	Unknown	0.52
Cabin Creek	4	B6c, C6b	FAR	Static	1.32
Cabin Creek	4	A4	NF	Unknown	1.0
Cold Creek	11	G4	FAR	Up	0.85
Corral Creek	4	A2a	FAR	Static	0.5
Deep Creek	18	C	NF	Static	5.17
Deep Creek (S. Fork)	18	C6	NF	Down	4.34
Edie Creek	**10**	**A4, B4**	**FAR**	**Up**	**4.81**
Horse Creek	15	A4, G4	PFC	Up	1.4
Indian Creek (E. Fork)	4	B3, B4c	PFC	Up	4.1
Indian Creek (W. Fork)	5	B	FAR	Unknown	1.91
Indian Creek (W. Fork)	5	A4	NF	Unknown	2.06

Table 22 Continued **Stream**	**WBID**	**Rosgen Channel Type**	**Health**	**Trend**	**Miles**
Irving Creek (E. Fork)	12	B4a	FAR	Static	1.6
Irving Creek (W. Fork)	**12**	**G4, B4**	**NF**	**Down**	**1.09**
Medicine Lodge Creek	**6**	**B4, E4, G4**	**FAR**	**Unknown**	**2.33**
Dry Creek	9	C4, C3	FAR	Static	1.16
Middle Creek	7	G4, F4	FAR	Unknown	2.61
Warm Creek	13	B5c	FAR	Unknown	0.71
Warm Springs Creek	**20**	**A, B**	**NF**		**1.77**

Bold type indicates that stream is on the 1998 303(d) list.

Status of Beneficial Uses

The data presented in this section confirms the designated beneficial uses for salmonid spawning and cold water aquatic life for listed streams and unlisted streams within the Medicine Lodge Subbasin are not fully supported. The depth fines data shows the majority of sites in steams listed for sediment exceed the sediment target level of 28% or less fines.

In addition, thermograph data collected within the medicine lodge subbasin exceeds the temperature criteria for salmonid spawning in all streams sampled. Cold water fisheries and aquatic life have been observed in all streams with temperature data except Deep Creek. Therefore, it is assumed that salmonid spawning is an existing use within these streams that is not fully supported.

Thermograph data collected on the Warm Springs Creek indicates that the stream is naturally thermal with relatively constant temperatures ranging from 25ºC to 28ºC. Only warm water species of fish have been found in the creek, and it is therefore recommended that the stream be designated for warm water aquatic life or seasonal cold water aquatic life.

Conclusions

- It is recommended that TMDLs for nutrients not be written for any of the streams in the watershed. The nutrient data collected by the BLM indicates that nutrient enrichment was not of concern for the streams listed for nutrients and there is no observational data present indicating excessive slime growth in any part of the watershed indicating that the listing was in error.

- Sediment TMDLs will be developed for Edie Creek, Irving Creek and Medicine Lodge Creek. Edie Creek and Irving Creek have spawning habitat within the listed reaches while the listed segment of Medicine Lodge is rearing habitat. A TMDL is still necessary for this section of Medicine Lodge Creek because sediment impacts the macroinvertebrate population, therefore impacting the food source for the fish. McNeil core sample data found more than 66% fine sediment in the Medicine Lodge Creek listed segment. It is recommended that a load reduction target be quantified for the upper reaches of Medicine Lodge Creek as well since it is a source reach for the listed segment and also contains salmonid spawning habitat.

- Temperature TMDLs are needed for all streams within the Medicine Lodge Subbasin which temperature data was collected, with the exception of Warm Springs Creek, Divide Creek, Deep Creek, and the lower section of Medicine Lodge Creek, since the lower portion is considered rearing habitat for fish and therefore not salmonid spawning habitat. All streams sampled exceed temperature criteria for salmonid spawning and it is recommended TMDLs be developed for those streams, with the exception of Deep Creek. It is likely temperature TMDLs will be met though improved width/depth ratios, increases canopy cover, and water conservation practices that will be completed as part of the implementation plan for these TMDLs.

- Fisheries or cold water indicators were not observed in past monitoring events on Deep Creek, therefore, existing uses on Deep Creek have not been determined. Additional monitoring will be necessary to determine the status of beneficial uses.

- The information presented in this subbasin assessment indicated that the development of a temperature total maximum daily load (TMDL) is unnecessary for Warm Springs Creek because it is naturally thermal. It is recommended that Warm Springs Creek be delisted for sediment since depth fines data collected was at 28% and streambanks appeared to be in fairly stable condition.

2.4 Data Gaps

Water quality data gaps that currently exist in the Medicine Lodge subbasin include:

- Further investigation of nutrients is needed to determine beneficial use status of the nutrient listed streams. Nutrient samples have not been taken on Fritz Creek, which is on the 1998 303(d) list for nutrients. Nutrient sampling in the rest of the subbasin has been conducted by the BLM, but since there is no BLM land on Fritz Creek, they have not sampled it.

- Fish sampling is quite comprehensive throughout the subbasin, however, it would be helpful to conduct more electrofishing on Crooked Creek. The USFS found 19 Yellowstone Cutthroat trout in the creek in 1997, but did not measure the fish. We do not know how many age classes are present, and therefore cannot assess the health of the population. The DEQ also electrofished Crooked Creek in 1997 and again in 2000, but did not collect any fish.

- Additional streambank erosion inventories should be conducted on all listed streams. The Soil Conservation Commission collected a wealth of streambank assessment information including streambank erosion inventories for four of the streams on the 1998 303(d) list. These inventories only included private land, however, and complimentary information should be collected for the upper reaches of these streams.

- Further thermograph data should be collected on all streams within the Medicine Lodge Subbasin. Additional thermograph data on Divide Creek should be collected since the stream reach was observed as dry during the 2000 sampling period, causing the data collected to be considered invalid. Existing data presented in this document suggests that all streams within the Subbasin, with the exception of Warm Springs Creek, Divide, Creek, Deep

Creek, and the lower end of Medicine Lodge Creek, need a temperature TMDL. Additional thermograph data on Warm Spring creek should be collected to determine beneficial use attainment.

- Salmonid spawning temperature criteria's set in this TMDL should also be further evaluated during implementation of this TMDL to ensure the standards set are reflective of spawning time periods in the Medicine Lodge Subbasin.

- No data has been collected on Blue Creek. It is recommended this stream be monitored to determine if it is supporting existing beneficial uses.

- Further monitoring information should be collected on Deep Creek to determine the existing uses and their status.

3.0. Subbasin Assessment – Pollutant Source Inventory

The Medicine Lodge Subbasin has no known point sources of pollution, therefore, there are no National Pollution Discharge Elimination System (NPDES) permits within its boundaries. Major nonpoint pollution sources in this subbasin consist of land disturbance from grazing, unmaintained roads, farming, and recreation. The following provides an overview of nonpoint sources by watershed for streams currently listed as water quality limited (1998 303(d) list). There are currently five water bodies listed on the 1998 303(d) list.

3.1 Sources of Pollutants of Concern

The Medicine Lodge subbasin contains only non-point sources within the watershed. As described in section 1.3. The primary uses within this subbasin are agricultural land uses.

- Medicine Lodge Creek

Medicine Lodge Creek is on the 303(d) list for sediment, temperature and flow alteration. TMDLs are not conducted for flow alteration due to DEQ policy. Medicine Lodge Creek is listed from Spring Hollow to Small, ID, which is about 16.2 stream miles. Within the drainage of the listed section of Medicine Lodge Creek, the land is primarily used for grazing. The lower portion of the stream also supports irrigated farming.

Most of the tributaries to Medicine Lodge Creek begin on land managed by the USFS and then flow through a mixture of BLM and private ground before reaching Medicine Lodge Creek. The main stem of Medicine Lodge Creek primarily flows through private land and small patches of BLM land. The USGS monitored water flow in two places on Medicine Lodge Creek. The hydrograph from the station located at Small, ID indicates that a major flooding event occurred in the subbasin in 1995. This high flow event caused several culverts in the subbasin to fail and induced damage to streambanks that can still be seen today.

Depth fine material sampling at Small, ID had 32.7% fine material (<6.35 mm) and 66.5% at a mid-section of Medicine Lodge Creek, both exceeding DEQ's adapted target of <28% fine sediment. Three thermographs were placed in Medicine Lodge Creek during the 2000 season by DEQ. The USFS also placed a thermograph on Medicine Lodge Creek during the 2000 season. All four thermographs reported a major exceedance of the salmonid spawning temperature criteria of thirteen degrees C or less with a maximum daily average no greater than nine degrees C. None of the thermographs had a major criteria exceedance of the cold water aquatic life criteria.

- Edie Creek

Edie Creek is listed for nutrients, sediment and habitat alteration. TMDLs are not conducted for habitat alteration due to DEQ policy. Edie Creek is listed from the headwaters to the confluence with Medicine Lodge Creek, which is about 7.7 stream miles. The entire drainage of Edie Creek is used for grazing of livestock. A very small percentage of irrigated farming takes place along the creek in the lower portion. The headwaters of Edie Creek are on BLM land and the lower 2.5 miles of the stream flows through private property.

The road crosses Edie Creek six times on the BLM land. Depth fines were sampled from Edie Creek in 2000 by the DEQ. The percentage of fine material through core sampling at a mid-section of Edie Creek had 37.4% of fine material (<6.35mm).

The BLM also sampled nutrients on Edie Creek in the 2000 season. Sampling included Nitrate-Nitrite, total Kjeldahl Nitrogen, Total Phosphorus, and Ortho-phosphate. None of the sites on Edie Creek exceeded recommendations for these nutrients.

- Irving Creek

Irving Creek is listed for nutrients, sediment and habitat alteration. Its 303(d) boundaries are from the headwaters to the confluence with Medicine Lodge Creek (6.9 stream miles). Irving Creek's drainage area is almost entirely used for rangeland for livestock. There is a small amount of farming conducted on the private land along the stream. Irving Creek begins on USFS land and flows onto BLM land for approximately 1.1 miles and then onto private land until it converges with Medicine Lodge Creek.

Sediment samples taken on Irving Creek indicate a high amount of erosion. The stream has highly erodible banks and severe cutbanks in the upper reaches. DEQ depth fines found fine material (<6.35 mm) at 45.65%.

The BLM also sampled nutrients on Irving Creek in the 2000 season. Sampling included Nitrate-Nitrite, total Kjeldahl Nitrogen, Total Phosphorus, and Ortho-phosphate. None of the sites on Edie Creek exceeded recommendations for these nutrients.

- Fritz Creek

Fritz Creek is listed from the forks to the confluence with Medicine Lodge Creek (2.9 stream miles) and is on the 1998 303(d) list for nutrients and temperature. The entire listed segment of Fritz Creek is used for grazing. The headwaters of the north and south forks begin in forest habitat on land managed by the USFS. Below the confluence of the north and south forks of

Fritz Creek, the stream flows through private land until the confluence with Medicine Lodge Creek.

Three thermographs were placed on Fritz Creek in 2000, two by the DEQ and one by the USFS. All three thermographs had a major criteria exceedance of the salmonid spawning criteria, but did not have a major criteria exceedance for the cold water aquatic life criteria. Nutrients have not been sampled on Fritz Creek.

- Warm Springs Creek

Warm Spring Creek is on the 1998 303(d) list for nutrients and sediment. It is listed from the headwaters to the sinks, about 19.4 stream miles. The headwater of Warm Springs Creek is on BLM land, and the entire stream flows intermittently through private and BLM managed land. The drainage for Warm Springs Creek is used for rangeland.

Depth fine material sampling in 2000 reported 28.1% fine material (<6.35 mm) which is almost within the target level for fine sediment. This target, however, has been set for salmonid spawning and Warm Springs Creek is naturally thermal and devoid of salmonid fishes.

The BLM also sampled nutrients on Irving Creek in the 2000 season. Sampling included Nitrate-Nitrite, total Kjeldahl Nitrogen, Total Phosphorus, and Ortho-phosphate. None of the sites on Edie Creek exceeded recommendations for these nutrients.

3.2 Data Gaps

There is little information concerning specific contributions of non-point sources within this subbasin. A more detailed breakdown of pollutant contributions from non point sources, such as irrigated agriculture, rangelands used for grazing, diversions, and roads would be of benefit for analysis of pollutant loading. Analysis of seasonal variation of pollutant loading also may warrant further evaluation to determine if it should be a concern.

4. Subbasin Assessment – Summary of Past and Present Pollution Control Efforts

- NRCS EQUIP Project

EQUIP is the Environmental Quality Incentives Program and was established in the 1996 Farm Bill to provide assistance for farmers and ranchers for improvement projects. The program was specifically designed for areas with serious threats to soil and water quality.

The EQUIP project in Medicine Lodge is located at Small, ID and is designed to be an educational project to display different techniques available and encourage other landowners to consider implementing EQUIP projects. This site in particular was chosen due to its visibility because it is on the main Medicine Lodge road. The site implemented various techniques such as rock barb, brush boxes, riprap, and decreasing livestock access to a water gap.

- NRCS Indian Creek Project

A state funded project took place on Indian Creek in the spring of 1999 through the Range Conservation Resource Development Program (RCRDP). The project included riparian restoration and reintroduction of beaver to the stream. The riparian restoration consisted primarily of willow planting and fencing, and there has been close to a 100% success rate for the planted vegetation.

In addition to the riparian restoration project, the RCRDP project has proposed to move 40 beaver. Eleven beaver were reintroduced into the BLM and USFS land on the east and west forks of Indian Creek in the first year. Several beaver dams have been documented in Indian Creek since the beavers were introduced.

- Conservation Reserve Program (CRP)

There are currently 5 landowners in the Medicine Lodge Subbasin who have applied for Continuous CRP. The project would include installing approximately 485 acres of riparian forest buffer with livestock exclusions. Additional applications for C-CRP are expected.

- Idaho Nonpoint Source Grant Program

In 1987 Congress enacted section 319 of the Clean Water Act to issue annual grants to States, Territories and Tribes. The money from this program is to be used to implement Watershed Restoration Actions Strategies (WRASs) to control nonpoint source pollution.

The Clark Soil Conservation District is requesting money through this program to replace seven deficient diversions located on Medicine Lodge Creek and Irving Creek. These will have a direct positive effect on water quality, fish and wildlife habitat, fish passage and the stabilization of stream channels. The diversions will be the first step in the implementation plan of the Soil Conservation Commission. Subsequent implementation efforts will include prescribed grazing, streambank stabilization, buffers and stream channel stabilization. The draft implementation plan for the Medicine Lodge subbasin is presented in Appendix F.

- Teton Regional Land Trust

The Teton Regional Land Trust Inc. (TRTL) is a non-profit, community organization with the mission to conserve agricultural and natural lands and encourage land stewardship in the Upper Snake River Valley. They serve six Idaho counties: Bonneville, Clark, Fremont, Jefferson, Madison and Teton; and Teton County, Wyoming, west of the Tetons.

TRTL is a small grassroots organization that was started by a number of concerned citizens who wanted to protect the agricultural and natural values of this region. TRTL members are farmers, ranchers, and residents interested in protecting the land, rivers and communities for generations to come. TRTL identifies the tools and resources for landowners to better manage their lands and find ways to help families retain their farms and ranches that are threatened by development.

TRLT has worked with private landowners in the Medicine Lodge Subbasin to put 2,617 acres of private land into conservation easements. This land encompasses different areas throughout the drainage, and legally limits the amount of development that can take place on the land.

- Caribou-Targee National Forest

The Caribou-Targee National Forest has completed a project to reduce streambank erosion within the Medicine Lodge Subbasin. The main actions include installing several enclosures along Fitz Creek.

5. Total Maximum Daily Load(s)

A TMDL prescribes an upper limit on discharge of a pollutant from all sources so as to assure water quality standards are met. It further allocates this load capacity (LC) among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a waste load allocation (WLA); and nonpoint sources, which receive a load allocation (LA). Natural background (NB), when present, is considered part of the load allocation, but is often broken out on its own because it represents a part of the load not subject to control. Because of uncertainties regarding quantification of loads and the relation of specific loads to attainment of water quality standards, the rules regarding TMDLs (40 CFR § 130) require a margin of safety (MOS) be a part of the TMDL.

Practically, the MOS is a reduction in the load capacity that is available for allocation to pollutant sources. The natural background load is also effectively a reduction in the load capacity available for allocation to human made pollutant sources. This can be summarized symbolically as the equation: LC = MOS + NB + LA + WLA = TMDL. The equation is written in this order because it represents the logical order in which a loading analysis is conducted. First the LC is determined. Then the LC is broken down into its components: the necessary MOS is determined and subtracted; then NB, if relevant, is quantified and subtracted; and then the remainder is allocated among pollutant sources. When the breakdown and allocation is completed we have a TMDL, which must equal the LC.

Another step in a loading analysis is the quantification of current pollutant loads by source. This allows the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary in order for pollutant trading to occur. Also a required part of the loading analysis is that the LC be based on critical conditions – the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both LC and pollutant source loads vary, and not necessarily in concert, determination of critical conditions can be more complicated than it may appear on the surface.

A load is fundamentally a quantity of a pollutant discharged over some period of time, and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for "other appropriate measures" to be used when necessary. These "other measures" must still be quantifiable, and relate to water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads, and allow "gross allotment" as a load allocation where available data or appropriate predictive techniques limit more accurate estimates. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads.

5.1 Instream Water Quality Targets

The goal of this TMDL is to restore "full support of designated beneficial uses" on all 303(d) listed streams within the Medicine Lodge subbasin. Water quality pollutants of concern, for which a TMDL has been being developed, are sediment and temperature. The objective for this TMDL will be to establish a declining trend in sediment loading, and to regularly monitor the sediment load and to decrease water temperatures throughout the subbasin by increasing canopy coverage and decreasing width/depth ratios along streambanks for attainment of beneficial use support. The sediment target for this TMDL will be the percentage of subsurface fines less than 6.35 mm (0.25 in) sediment and 80 % stable streambanks. This will be done by measuring the percentage of subsurface fines and conducting stream bank erosion inventories. A sediment TMDL has been developed for Medicine Lodge Creek, Irving Creek, and Edie Creek.

The temperature TMDL target is the numeric salmonid spawning criteria listed in the state water quality standards [IDAPA 58.01.02.250.02.b]. Instream targets shall be less than the instantaneous temperature 13ºC (55.4ºF) and the maximum daily average temperature below 9ºC (48.2ºF) during salmonid spawning periods. Based on thermograph data presented in the subbasin assessment, all streams in which thermal data has been collected within the Medicine Lodge subbasin exceed temperature criteria for salmonid spawning, therefore, all streams will have a temperature TMDL, with the exception of the lower portion of Blue Creek, Medicine Lodge Creek, Warm Springs Creek, Divide Creek, and Deep Creek due to reasons described in Sections 2.3 and 2.4 of the Subbasin Assessment.

Design Conditions

- Seasonal Variation and Critical Time Periods of Sediment Loading

To qualify the seasonal and annual variability and critical timing of sediment loading, climate and hydrology must be considered. This sediment analysis characterizes sediment loads using average annual rates determined from empirical characteristics that developed over time within the influence of peak and base flow conditions. While deriving these estimates it is difficult to account for seasonal and annual variation within a particular time frame, however, the seasonal and annual variation is accounted for over the longer time frame under which observed conditions have developed.

Annual erosion and sediment delivery are greatly a function of climate where wet water years typically produce the highest sediment loads. Additionally, annual average sediment load is not distributed equally throughout the year. Erosion typically occurs during a few critical months. For example, in the Medicine

Lodge watershed, most streambank erosion occurs during spring runoff while most hillslope erosion occurs during summer thunderstorms and spring runoff.

This sediment analysis uses empirically derived hydrologic concepts to help account for variation and critical time periods. First, field-based methods consider critical hydrologic mechanisms. For example streambank erosion inventories account for the fact that most bank recession occurs during peak flow events when banks are saturated. Second, the estimated annual average sediment delivery from a given watershed is a function of bankfull discharge or the average annual peak flow event

Temperature Critical Time Periods

- The critical time periods for salmonid spawning when salmonid spawning temperature criteria should be met within the Medicine Lodge Subbasin are identified as occurring during May 1 through July 15, for rainbow trout and Yellowstone cutthroat trout; and October 1 through November 15, for brook trout. The salmonid spawning critical time periods for species within this subbasin are default periods from the Water Body Assessment Guidance, second edition (WBAG). According to the WBAG manual, brook trout salmonid spawning periods are from October 1 through June 1, however, for this TMDL, salmonid spawning criteria was not considered past November 15 since it is likely that temperature exceedances will not occur after November 15 and temperature data was not collected beyond this date.

Target Selection

- Target selection of sediment is dependent on existing narrative criteria of [IDAPA 58.01.02.200.08].

- Sediment Targets for this subbasin are based on streambank erosion quantitative allocations in tons per year. Reduction in stream bank erosion prescribed within this TMDL is directly linked to the improvement of riparian vegetation density and structure to armor streambanks, reduce lateral recession, trap sediment and reduce the erosive energy of the stream thus reducing instream sediment loading. It is assumed that by reducing chronic sources of sediment, there will be a decrease in subsurface fine sediment that will ultimately improve the status of beneficial uses. Therefore, the established instream water quality target of 28%or less fine sediment <6.35mm in areas suitable for salmonid spawning. If sites meet this criterion, beneficial uses for salmonid spawning are likely full support.

- Other parameters for subsurface fines can affect salmonid production. Chapman (1988) suggested that fine sediment <0.85 mm (0.03 in) in diameter is most responsible for suffocation and abrasion of salmonid eggs. Tappel and Bjornn (1983) report that sediment <9.5mm (0.37 in) in diameter can create a survival barrier preventing salmonid fry emergence from the redd. Hall

(1986) found survival (eyed-egg to emergence) of coho, chinook and chum salmon to be only 7-10% in gravel mixtures made up of 10% fines as compared to 50-75% survival in gravel mixtures with no fines <0.85 mm (0.03 in). Reiser and White (1988) observed little survival of steelhead and chinook salmon eggs beyond 10-20% fines <0.85 mm (0.03 in). These sediment particle size parameters should be considered as part of target < 0.85 mm (0.03 in). These sediment particle size parameters should be considered as part of target monitoring to evaluate any significant shift in subsurface fine particle frequency distribution.

- In addition to sediment substrate sampling, streambank erosion inventories will be conducted on Medicine Lodge Creek, Irving Creek, and Edie Creek. It is assumed that that natural background sediment loading rates equate to 80% bank stability as described in Overton and others (1995), where banks are expressed as a percentage of the total estimated bank length. Natural condition streambank stability potential is generally 80% or greater for Rosgen A, B, and C channel types in plutonic, volcanic, metamorphic, and sedimentary geology types. Therefore, an 80% bank stability target based on streambank erosion inventories shall be the target for sediment.

- Temperature TMDL criteria is based on existing numeric criteria of [IDAPA 58.01.02.250(02)(e)(ii)] for salmonid spawning. Instream targets shall be less than the instantaneous temperature 13ºC (55.4ºF) and the maximum daily average temperature below 9ºC (48.2ºF) during salmonid spawning periods.

Monitoring Points

- Subsurface Sediment Monitoring

Subsuface sediment substrate monitoring points shall occur in habitat determined suitable for salmonid spawning within listed stream segments using the McNiel core sediment sampling method. The amount of habitat suitable for salmonid spawning will increase after implementation of management practices identified to reduce subsurface fine sediment.

- Streambank Stability Monitoring

Streambank erosion inventories shall occur along the entire reaches of Medicine Lodge Creek, Irving Creek, and Edie Creek.

- Temperature Monitoring

Temperature monitoring points shall be collected at existing temperature logger data collection sites to maintain consistency with past monitoring events. Site locations for temperature loggers are described in Appendix E.

5.2 Load Capacity

The load capacity of a stream or waterbody is "the greatest amount of loading a water can receive without violating water quality standards" [40 CFR §130.2]. This must be a level to meet "...water quality standards with season variations and a margin of safety which takes into account any lack of knowledge..." (CWA § 303(d)(C)). Likely sources of uncertainty include lack of knowledge of assimilative capacity, uncertain relation of selected target(s) to beneficial use(s), and variability in target measurement.

- Sediment loading capacities for Medicine Lodge Creek, Irving Creek, and Edie Creek, are quantitatively estimated in tons per year as shown in Table 23. These numbers are based on streambank erosion inventories conducted by the Soil Conservation Commission and Natural Resources Conservation Service in 2000.

Table. 23 Sediment Load Capacity

Steam Name	**Proposed Total Erosion (t/y)**	**Proposed Erosion Rate (t/mi/y)**
Edie Creek	95.4	36.7
Irving Creek	376.2	89.6
Medicine Lodge Creek	1210.2	46

- Sediment target levels are based on natural streambank erosion inventories. Since it is assumed that natural stream bank erosion targets of 80% or greater and the substrate sediment target of 28% or less fine sediment substrate <6.35 mm will support beneficial uses, these are also used in calculating loading capacities for Medicine Lodge Creek, Edie Creek, and Irving Creek.

- The natural background loading rates are not necessarily the loading capacities. An adaptive management approach will be used to provide reductions in sediment loadings based on BMP usage coupled with data collection and monitoring to determine the loading point at which beneficial uses are at full support.

- The estimated capacity is directly related to the improvement of riparian vegetation density and structure as well as maintenance of stream crossings. Increased vegetative cover provides a protective covering of streambanks, reduces lateral recession, traps sediment and reduces erosive energy of the stream..

- The temperature load capacity for the purpose of this TMDL is determined by state water quality standards for temperature based on numeric water quality criteria for salmonid spawning and cold water aquatic life.

- The temperature loading capacity for salmonid spawning shall be less than the instantaneous temperature 13ºC (55.4ºF) and the maximum daily average temperature below 9ºC (48.2ºF) during salmonid spawning periods. Salmonid spawning periods for the Medicine Lodge subbasin are May 1 through June 30 for Rainbow Trout and Cutthroat Trout and, October 1 through November 15 for Brook Trout.

5.3 Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading," (40 CFR 130.2(I)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of sources (land use) and area (such as a subwatershed), but may be aggregated by type of source or land area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads.

- Method(s) of Estimation of Allocation
  The method of estimation of allocation used is based on the principal TMDL equation:

  TMDL = Load Capacity = Waste Load Allocation + Load Allocation + Margin of Safety

- The load capacity is an estimate of loading a water body can handle and can still meet water quality standards, as previously defined in Section 5.2.

- Waste Load Allocation (WLA) is the amount of loading contributing to a water body from point sources within the watershed. There are no point sources within the Medicine Lodge subbasin therefore, WLA is equal to zero.

- Load Allocation (LA) is the amount of loading contributing to a water body from non point sources within the watershed. All contributing loads to the Medicine Lodge watershed result from nonpoint sources within the watershed. Land uses within the Medicine Lodge are primarily agriculture related, therefore agriculture is the primary contributing source of loading. Other contributing non-point sources include roads, diversions, and recreational activities.

- Margin of Safety (MOS) accounts for uncertainty in available data in which load allocations are derived. In this case, the margin of safely is implicit for both sediment and temperature loading. The MOS is described in Section 5.4.

- Seasonal variation for sediment loading and temperature loading were considered for this TMDL. Sediment loading of streams is episodic in nature. It is not possible to monitor a stream each time bank erosion or sloughing occurs. Sediment streambank erosion inventories account for the fact that most bank recession occurs during peak flow events when banks are saturated, typically during the spring and early summer months. The accumulative load from bank mass wasting is accounted for in sediment inventory monitoring, thus erosion inventory monitoring takes into account seasonal variation of streambank erosion. Seasonal variation in the temperature TMDLs are accounted for by evaluating temperatures exceedances during critical spring and fall salmonid spawning periods and temperature exceedances observed during the summer months, when temperatures are the highest. Further collection of data during implementation of this TMDL may warrant adjustments for seasonal variation to the current TMDL.

- Current sediment loading for Medicine Lodge Creek, Irving Creek, and Edie Creek, are quantitatively estimated in tons per year as shown in Table 24. These numbers are based on streambank erosion inventories conducted by the Soil Conservation Commission and Natural Resource Conservation Service in 2000.

Table. 24 Estimated Current Load for Sediment in the Medicine Lodge Subbasin

Steam	Existing Total Erosion (t/y)	Existing Erosion Rate (t/mi/y)
Edie Creek	484.5	186.3
Irving Creek	2026.2	482.4
Medicine Lodge Creek	3368.1	128.1

- Current temperature loading for streams exceeding salmonid spawning criteria within the Medicine Lodge subbasin is listed in Table 25. Temperature readings using temperature data loggers occurred for June 16 through October 16, 2000. Exceedances are triggered during salmonid spawning periods which are May 1 through July 1 and October 1through November 15. Data collected indicated all streams within the Medicine Lodge subbasin exceeded salmonid spawning criteria at least 10% of the time, and thus, a violation in these standards (IDEQ, 2000).

- A Temperature TMDL for the lower reach of Medicine Lodge Creek will not be done since this section is considered rearing but not spawning habitat for salmonids, as described in Section 2.3 on the subbasin assessment.

Table. 25 Estimated Current Load for Temperature in the Medicine Lodge Subbasin

Stream Name	Maximum Number of Days Exceedances[a]	Highest Instantaneous Value (ºC)	Highest Average Daily Value (ºC)
Crooked Creek	30	19.00	12.02
Deep Creek	39	25.3	18.4
East Fork Irving Creek	18	13.39	9.68
Edie Creek (at BLM Boundary)	30	17.79	12.84
Edie Creek (at mouth)	30	16.78	13.55
Fritz Creek (at mouth)	30	20.65	14.23
Fritz Creek (below forks)	29	18.02	13.73
Horse Creek	38	18.13	14.96
Indian Creek	30	18.60	13.46
Irving Creek (at mouth)	30	19.13	13.99
Medicine Lodge Creek (above Middle Creek)	30	19.01	16.48
Medicine Lodge Creek (at Small, ID)	30	19.55	17.47
Medicine Lodge Creek (at Spring Hollow)	30	20.21	15.86
Middle Creek (mouth)	30	18.91	15.70
Warm Creek	30	20.84	17.80
Webber Creek (at mouth)	31	18.60	13.80
Webber Creek (at trailhead)	24	15.58	11.26

[a] Exceedances are considered any day exceeding 13º C instantaneous value or 9º C average daily value or 22 ºC (71.6 º F) and the maximum daily average temperature below 19 ºC (66.2 ºF) for streams exceeding CWAL criteria.

5.4 Load Allocation

The load allocation is the amount of loading capacity allocated to a given water body source without exceeding water quality criteria. For the Medicine Lodge subbasin, load allocations have been developed for sediment and temperature. As described in section 5.3, the TMDL is equal to the sum of all load allocations which is equal to the load capacity of the stream. Table 26, 27, and 28 provide the load capacities for each stream and the total reduction from the current loading rates to meet load capacities within the streams. Temperature load capacities are the state water quality numeric criteria.

Table 26. Existing and Proposed Sediment Erosion and Associated Reductions.

	Estimated Load		Load Capacity / Load Allocation		Reduction Needed		
Stream	**Existing Total Erosion (t/y)**	**Existing Erosion Rate (t/mi/y)**	**Proposed Total Erosion (t/y)**	**Proposed Erosion Rate (t/mi/y)**	**Total Erosion Reduction (t/y)**	**Total Erosion Reduction Rate (t/mi/y)**	**Percent Reduction Needed to meet Load capacity**
Edie Creek	484.5	186.3	95.4	36.7	389.1	149.6	80.3%
Irving Creek	2026.2	482.4	376.2	89.6	1650.2	392.8	81.4%
Medicine Lodge Creek	3368.1	128.1	1210.2	46.0	2157.9	82.1	64.1%

?? The TMDL for Edie Creek, Irving Creek, and Medicine Lodge Creek are 95.4, 376.2, and 1210.2 tons/year, respectively. Percent reduction of the existing sediment load for Edie Creek, Irving Creek, and Medicine Lodge Creek are 80.3%, 81.4%, and 64.1% respectively.

Table 27. Existing and Proposed Temperature Loads and Reductions for Salmonid Spawning.

		Estimated Load		Reduction Needed	
Stream Name	**Maximum number of days exceedances ***	**Highest Instantaneous Value (ºC)**	**Highest average daily value (ºC)**	**% Reduction needed to attain 13ºC instantaneous value**	**% Reduction to attain 9ºC average daily value**
Crooked Creek	30	19.00	12.02	31.6%	25.1%
Deep Creek	39	25.3	18.4	48.6%	51.1%
East Fork Irving Creek	18	13.39	9.68	2.9%	7.0%
Edie Creek (at BLM Boundary)	30	17.79	12.84	26.9%	29.9%
Edie Creek (at mouth)	30	16.78	13.55	22.5%	33.6%
Fritz Creek (at mouth)	30	20.65	14.23	37.0%	36.8%
Fritz Creek (below forks)	29	18.02	13.73	27.9%	34.5%

Stream Name	Maximum number of days exceedances *	Estimated Load: Highest Instantaneous Value (ºC)	Estimated Load: Highest average daily value (ºC)	Reduction Needed: % Reduction needed to attain 13ºC instantaneous value	Reduction Needed: % Reduction to attain 9ºC average daily value
Horse Creek	38	18.13	14.96	28.3%	39.8%
Indian Creek	30	18.60	13.46	30.1%	33.1%
Irving Creek (at mouth)	30	19.13	13.99	32.0%	35.7%
Medicine Lodge Creek (above Middle Creek)	30	19.01	16.48	31.6%	45.4%
Medicine Lodge Creek (at Spring Hollow)	30	20.21	15.86	35.7%	43.3%
Middle Creek (at mouth)	30	18.91	15.70	31.3%	42.7%
Warm Creek	30	20.84	17.80	37.6%	49.4%
Webber Creek (at mouth)	31	18.60	13.80	30.1%	34.8%
Webber Creek (at trailhead)	24	15.58	11.26	16.6%	20.1%

*exceedances are considered any day exceeding 13ºC instantaneous value or 9ºC average daily value

- The percent reduction in temperature are based on the highest recorded temperatures during the June 16 through October 16 monitoring period during the salmonid spawning critical time periods. Percent temperature reductions range from 2.9% reduction on East Fork Irving Creek to 51.1% on Deep Creek. The highest percent reduction values shown for each stream segment is the TMDL.

Load Allocations by Land Ownership

- Load allocations by land ownership will not be done for this TMDL. The sediment load reductions are based solely on streambank erosion inventories therefore, the contributing source is linked solely to stream bank erosion. During Implementation of this TMDL, management practices to reduce streambank erosion will be employed. An adaptive management approach will be used to provide reductions in sediment loadings based on BMP usage coupled with data collection and monitoring to determine the loading point at which beneficial uses are at full support. The effectiveness of these activities will be monitored every other year through sediment substrate sampling and streamank erosion inventories.

- It is assumed that, as riparian conditions improve over the listed reaches in the Medicine Lodge Subbasin as part of implementation activities, the added benefit of reduced thermal loading will likely be realized and the temperature regime in these streams will likely improve.

- Management practices for streams that are not listed but exceed temperature criteria based on temperature data collected and summarized within this subbasin assessment and TMDL will be to increase streambank cover and decrease width/depth ratios, and implement water conservation practices will decrease thermal loading.

Seasonal Variation

- Seasonal variability was integrated in the development of this TMDL. The largest amount of sediment loading typically occurs during the spring and early summer run-off events with sporadic summer thunderstorm events also contributing. Stream erosion inventory monitoring accounts for the fact that most bank recession during peak flow events, which accounts for seasonal loading. By measuring how much the bank has receded each year, sediment erosion inventory monitoring records sediment loading events that typically occur episodically during the spring and early summer run-off events.

- Seasonal variability was incorporated into temperature TMDLs by taking into account the critical seasons for critical life stages of fish species present. Stream temperatures were evaluated during the hottest time of the year (summer), and during critical salmonid spawning time periods. The TMDL reductions are set during this period where there is the greatest exceedances and there is greatest variation between current in-stream temperature and the temperature criteria.

Margin of Safety

- The margin of safety (MOS) is factored into load allocations for sediment for Edie Creek, Irving Creek, and Medicine Lodge Creek. The MOS is the conservative assumptions used to develop existing sediment loads, where background conditions are more than needed to attain full support of uses are employed. Conservative assumptions made as part of the sediment loading analysis include: 1) Desired bank erosion rates are representative of background conditions of 80 %, as described in Overton and others ; 2) Water quality targets for percent depth fines of less than 28% (<6.35mm), are consistent with values measured and set by local land management agencies based on established literature values and incorporate a more than adequate level of fry survival to provide for stable salmonid production. It is assumed that the status of beneficial uses will be improved prior to the attainment of the targets of 80 % erosion rates and less than 28% depth fines in this TMDL.

- The MOS factored into load allocations for water temperature is based on the maximum observed temperature exceedances for each critical time period. Maximum exceedances of the most restrictive criteria were used to identify needed temperature reductions based upon the assumption that if temperature reductions are directed at eliminating the recorded maximum exceedance of criteria, then lesser exceedances will be eliminated during other times of the year.

Background

- It is assumed the beneficial uses were or would be more than supported at natural background sediment loading rates. Natural background loading rates are assumed to be natural the sediment loading capacity, based on an 80% or greater bank stability and 28% or less sediment substrate fines. Therefore natural background is accounted for in the load capacity. If it is established that full support of beneficial uses is achieved at intermediate sediment loads above natural background levels, and that narrative sediment standards are being met, the TMDL will be revised accordingly.

Reserve

- Since the loading capacity is assumed to be the natural background loading capacity, beneficial uses may be supported at high rates of sediment loading. If it is established that full support of beneficial uses is achieved at intermediate sediment loads and that narrative sediment standards are being met, the TMDL will be revised accordingly to allow for future growth.

5.5 Conclusions

The primary water quality concerns within the Medicine Lodge Subbasin are related to subsurface fine sediment deposited within the stream substrate and thermal loading during salmonid spawning periods, which is likely impacting the abundance and quality of fish habitat. The primary source of sediment and increased water temperatures appears to be streambank erosion. The primary cause of streambank erosion and increased temperatures is related to the downcutting of the stream channel and the subsequent sloughing of streambanks. Many areas of the Medicine Lodge watershed are re-establishing a flood plain. This process will likely take many years and will result in much additional streambank erosion. Riparian vegetation will likely re-establish on outside bends in which it is absent as the re-stabilization process takes place. Additionally, as riparian conditions improve over the listed reaches in the Medicine Lodge Subbasin, the added benefit of reduced thermal loading will likely be realized and the temperature regime in these streams will likely improve. For newly listed reaches for temperature, implementation will include increasing streambank cover, decrease width/depth ratios, and implementing water conservation practices similarly done on sediment listed streams. In addition, salmonid spawning temperature criterias set in this TMDL shall be further evaluated during implementation of this TMDL to ensure the standards set are reflective of spawning time periods in the Medicine Lodge Subbasin.

The development of an implementation plan for Medicine Lodge Creek Subbasin is currently underway and the draft plan is found in Appendix F. The implementation plan identifies Best Management Practices (BMPs) that will be implemented throughout the subbasin to improve riparian condition and stream channel habitat and reduce streambank erosion. BMPs that will be implemented within the subbasin focus on agricultural irrigation diversions, irrigation efficiency, and prescribed livestock grazing protection.

- It is anticipated that the amount of habitat suitable for salmonid spawning will increase after implementation of management practices identified to reduce subsurface fine sediment and steam temperatures. Subsurface fine sediment and salmonid age class structure and stream temperatures will be monitored every other year beginning at completion of the initial implementation phase. By the completion of the third monitoring period, if the percentage of subsurface fine sediment is not decreasing, additional management practices will be applied to attain the target

- It is anticipated that by reducing the chronic sediment load through increased streambank stability, the instream target of 28% subsurface fines and temperature supporting beneficial uses will be achieved. The beneficial use of natural spawning by salmonids should eventually be restored to full support prior to attaining the instream target set in this TMDL. Streambank stability, the percentage of subsurface fines in salmonid spawning habitat and age class structure of salmonids must be monitored every other year to determine the effectiveness of land management activities and of this TMDL.

References Cited

33 USC § 1251-1387. Federal water pollution control act (Clean Water Act).

40 CFR 130. Water quality planning and management.

American Geologic Institute. 1962. Dictionary of geologic terms. Doubleday and Company: Garden City, NY. 545 pp.

Armantrout, N. B. (compiler). 1998. Glossary of aquatic habitat inventory terminology. American Fisheries Society: Bethesda, MD. 136 pp.

Batt, P. E. 1996. Governor Philip E. Batt's Idaho bull trout conservation plan. State of Idaho, Office of the Governor: Boise, ID. 20 pp + appendices.

EPA. 1996. Biological criteria: technical guidance for streams and small rivers. EPA 822-B-96-001. U.S. Environmental Protection Agency, Office of Water: Washington, DC. 162 pp.

EPA. 1997. Guidelines for preparation of the comprehensive state water quality assessments (305(b) reports) and electronic updates: supplement. EPA-841-B-97-002B. U.S. Environmental Protection Agency: Washington, DC. 105pp.

Grafe, C. S., M. J. McIntyre, C. A. Mebane, and D. T. Mosier. 2000. The Idaho Department of Environmental Quality water body assessment guidance, second edition. Idaho Department of Environmental Quality: Boise, ID. 114 pp.

Hughes, R. M. 1995. Defining acceptable biological status by comparing with reference condition. *In* Davis, W.S. and T.P. Simon (editors). Biological assessment and criteria: tools for water resource planning. CRC Press: Boca Raton, FL. 31-48 pp.

Idaho Code § 39.3611. Development and implementation of total maximum daily load or equivalent processes.

Idaho Code § 3615. Creation of watershed advisory groups.

IDAPA 58.01.02. Idaho water quality standards and wastewater treatment requirements.

Karr, J. R. 1991. Biological integrity: a long-neglected aspect of water resource management. Ecological Applications. 1:66-84.

Public Law 92-50. Federal water pollution control act (Clean Water Act).

Public Law 100-4. Water quality act of 1987.

Rand, G. W. (editor). 1995. Fundamentals of aquatic toxicology: effects, environmental fate, and risk assessment, second edition. Taylor and Francis: Washington, DC. 1125 pp.

Strahler, A. N. 1957. Quantitative analysis of watershed geomorphology. American Geophysical Union Transactions. 38:913-920.

USGS. 1987. Hydrologic unit maps. United States Geological Survey water-supply paper 2294. U.S. Geological Survey: Denver, CO. 63 pp.

Water Environment Federation. 1987. The Clean Water Act of 1987. Alexandria VA. 318 pp.

Greenborg, A. E., L. S. Clescevi, and A. D. Eaton (editors). 1992. Standard methods for the examination of water and wastewater, 18th edition. American Public Health Association: Washington, DC.

Glossary

305(b)	Refers to section 305 subsection “b” of the Clean Water Act. 305(b) generally describes a report of each state’s water quality, and is the principle means by which the U.S. Environmental Protection Agency, congress, and the public evaluate whether U.S. waters meet water quality standards, the progress made in maintaining and restoring water quality, and the extent of the remaining problems.
303(d)	Refers to section 303 subsection “d” of the Clean Water Act. 303(d) requires states to develop a list of water bodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to U.S. Environmental Protection Agency approval.
Acre-Foot	A volume of water that would cover an acre to a depth of one foot. Often used to quantify reservoir storage and the annual discharge of large rivers.
Adsorption	The adhesion of one substance to the surface of another. Clays, for example, can adsorb phosphorus and organic molecules.
Aeration	A process by which water becomes charged with air directly from the atmosphere. Dissolved gases, such as oxygen, are then available for reactions in water.
Aerobic	Describes life, processes, or conditions that require the presence of oxygen.
Assessment Database (ADB)	The ADB is a relational database application designed for the U.S. Environmental Protection Agency for tracking water quality assessment data, such as use attainment and causes and sources of impairment. States need to track this information and many other types of assessment data for thousands of water bodies, and integrate it into meaningful reports. The ADB is designed to make this process accurate, straightforward, and user-friendly for participating states, territories, tribes, and basin commissions.

Adfluvial	Describes fish whose life history involves seasonal migration from lakes to streams for spawning.
Adjunct	In the context of water quality, adjunct refers to areas directly adjacent to focal or refuge habitats that have been degraded by human or natural disturbances and do not presently support high diversity or abundance of native species.
Alevin	A newly hatched, incompletely developed fish (usually a salmonid) still in nest or inactive on the bottom of a water body, living off stored yolk.
Algae	Non-vascular (without water-conducting tissue) aquatic plants that occur as single cells, colonies, or filaments.
Alluvium	Unconsolidated recent stream deposition.
Ambient	General conditions in the environment. In the context of water quality, ambient waters are those representative of general conditions, not associated with episodic perturbations, or specific disturbances such as a wastewater outfall (Armantrout 1998, EPA 1996).
Anadromous	Fish, such as salmon and sea-run trout, that live part or the majority of their lives in the salt water but return to fresh water to spawn.
Anaerobic	Describes the processes that occur in the absence of molecular oxygen and describes the condition of water that is devoid of molecular oxygen.
Anoxia	The condition of oxygen absence or deficiency.
Anthropogenic	Relating to, or resulting from, the influence of human beings on nature.

Anti-Degradation	Refers to the U.S. Environmental Protection Agency's interpretation of the Clean Water Act goal that states and tribes maintain, as well as restore, water quality. This applies to waters that meet or are of higher water quality than required by state standards. State rules provide that the quality of those high quality waters may be lowered only to allow important social or economic development and only after adequate public participation (IDAPA 58.01.02.051). In all cases, the existing beneficial uses must be maintained. State rules further define lowered water quality to be 1) a measurable change, 2) a change adverse to a use, and 3) a change in a pollutant relevant to the water's uses (IDAPA 58.01.02.003.56).
Aquatic	Occurring, growing, or living in water.
Aquifer	An underground, water-bearing layer or stratum of permeable rock, sand, or gravel capable of yielding of water to wells or springs.
Assemblage (aquatic)	An association of interacting populations of organisms in a given water body; for example, a fish assemblage, or a benthic macroinvertebrate assemblage (also see Community) (EPA 1996).
Assimilative Capacity	The ability to process or dissipate pollutants without ill effect to beneficial uses.
Autotrophic	An organism is considered autotrophic if it uses carbon dioxide as its main source of carbon. This most commonly happens through photosynthesis.
Batholith	A large body of intrusive igneous rock that has more than 40 square miles of surface exposure and no known floor. A batholith usually consists of coarse-grained rocks such as granite.
Bedload	Material (generally sand-sized or larger sediment) that is carried along the streambed by rolling or bouncing.
Beneficial Use	Any of the various uses of water, including, but not limited to, aquatic aquatic life, recreation, water supply, wildlife habitat, and aesthetics, which are recognized in water quality standards.

Beneficial Use Reconnaissance Program (BURP)	A program for conducting systematic biological and physical habitat surveys of water bodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers.
Benthic	Pertaining to or living on or in the bottom sediments of a water body.
Benthic Organic Matter	The organic matter on the bottom of a water body.
Benthos	Organisms living in and on the bottom sediments of lakes and streams. Originally, the term meant the lake bottom, but it is now applied almost uniformly to the animals associated with the lake and stream bottoms.
Best Management Practices (BMPs)	Structural, nonstructural, and managerial techniques that are effective and practical means to control nonpoint source pollutants.
Best Professional Judgment	A conclusion and/or interpretation derived by a trained and/or technically competent individual by applying interpretation and synthesizing information.
Biochemical Oxygen Demand (BOD)	The amount of dissolved oxygen used by organisms during the decomposition (respiration) of organic matter, expressed as mass of oxygen per volume of water, over some specified period of time.
Biological Integrity	1) The condition of an aquatic community inhabiting unimpaired water bodies of a specified habitat as measured by an evaluation of multiple attributes of the aquatic aquatic life (EPA 1996). 2) The ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the natural habitats of a region (Karr 1991).

Biomass	The weight of biological matter. Standing crop is the amount of biomass (e.g., fish or algae) in a body of water at a given time. Often expressed as grams per square meter.
Aquatic life	The animal and plant life of a given region.
Biotic	A term applied to the living components of an area.
Clean Water Act (CWA)	The Federal Water Pollution Control Act (Public Law 92-50, commonly known as the Clean Water Act), as last reauthorized by the Water Quality Act of 1987 (Public Law 100-4), establishes a process for states to use to develop information on, and control the quality of, the nation's water resources.
Coliform Bacteria	A group of bacteria predominantly inhabiting the intestines of humans and animals but also found in soil. Coliform bacteria are commonly used as indicators of the possible presence of pathogenic organisms (also see Fecal Coliform Bacteria).
Colluvium	Material transported to a site by gravity.
Community	A group of interacting organisms living together in a given place.
Conductivity	The ability of an aqueous solution to carry electric current, expressed in micro (µ) mhos/cm at 25 °C. Conductivity is affected by dissolved solids and is used as an indirect measure of total dissolved solids in a water sample.
Cretaceous	The final period of the Mesozoic era (after the Jurassic and before the Tertiary period of the Cenozoic era), thought to have covered the span of time between 135 and 65 million years ago.
Criteria	In the context of water quality, numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year. EPA develops criteria guidance; states establish criteria.

Cubic Feet per Second A unit of measure for the rate of flow or discharge of water. One cubic foot per second is the rate of flow of a stream with a cross-section of one square foot flowing at a mean velocity of one foot per second. At a steady rate, once cubic foot per second is equal to 448.8 gallons per minute and 10,984 acre-feet per day.

Cultural Eutrophication The process of eutrophication that has been accelerated by human-caused influences. Usually seen as an increase in nutrient loading (also see Eutrophication).

Culturally Induced Erosion Erosion caused by increased runoff or wind action due to the work of humans in deforestation, cultivation of the land, overgrazing, and disturbance of natural drainages; the excess of erosion over the normal for an area (also see Erosion).

Debris Torrent The sudden down slope movement of soil, rock, and vegetation on steep slopes, often caused by saturation from heavy rains.

Decomposition The breakdown of organic molecules (e.g., sugar) to inorganic molecules (e.g., carbon dioxide and water) through biological and nonbiological processes.

Depth Fines Percent by weight of particles of small size within a vertical core of volume of a streambed or lake bottom sediment. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 6.5 mm depending on the observer and methodology used. The depth sampled varies but is typically about one foot (30 cm).

Designated Uses Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act.

Discharge The amount of water flowing in the stream channel at the time of measurement. Usually expressed as cubic feet per second (cfs).

Dissolved Oxygen (DO) The oxygen dissolved in water. Adequate DO is vital to fish and other aquatic life.

Disturbance	Any event or series of events that disrupts ecosystem, community, or population structure and alters the physical environment.
E. coli	Short for *Escherichia Coli, E. coli* are a group of bacteria that are a subspecies of coliform bacteria. Most *E. coli* are essential to the healthy life of all warm-blooded animals, including humans. Their presence is often indicative of fecal contamination.
Ecology	The scientific study of relationships between organisms and their environment; also defined as the study of the structure and function of nature.
Ecological Indicator	A characteristic of an ecosystem that is related to, or derived from, a measure of a biotic or abiotic variable that can provide quantitative information on ecological structure and function. An indicator can contribute to a measure of integrity and sustainability. Ecological indicators are often used within the multimetric index framework.
Ecological Integrity	The condition of an unimpaired ecosystem as measured by combined chemical, physical (including habitat), and biological attributes (EPA 1996).
Ecosystem	The interacting system of a biological community and its non-living (abiotic) environmental surroundings.
Effluent	A discharge of untreated, partially treated, or treated wastewater into a receiving water body.
Endangered Species	Animals, birds, fish, plants, or other living organisms threatened with imminent extinction. Requirements for declaring a species as endangered are contained in the Endangered Species Act.
Environment	The complete range of external conditions, physical and biological, that affect a particular organism or community.
Eocene	An epoch of the early Tertiary period, after the Paleocene and before the Oligocene.

Eolian	Windblown, referring to the process of erosion, transport, and deposition of material by the wind.
Ephemeral Stream	A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long continued supply from melting snow or other sources. Its channel is at all times above the water table. (American Geologic Institute 1962).
Erosion	The wearing away of areas of the earth's surface by water, wind, ice, and other forces.
Eutrophic	From Greek for "well nourished," this describes a highly productive body of water in which nutrients do not limit algal growth. It is typified by high algal densities and low clarity.
Eutrophication	1) Natural process of maturing (aging) in a body of water. 2) The natural and human-influenced process of enrichment with nutrients, especially nitrogen and phosphorus, leading to an increased production of organic matter.
Exceedance	A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.
Existing Beneficial Use or Existing Use	A beneficial use actually attained in waters on or after November 28, 1975, whether or not the use is designated for the waters in Idaho's *Water Quality Standards and Wastewater Treatment Requirements* (IDAPA 58.01.02).
Exotic Species	A species that is not native (indigenous) to a region.
Extrapolation	Estimation of unknown values by extending or projecting from known values.
Fauna	Animal life, especially the animals characteristic of a region, period, or special environment.
Fecal Coliform Bacteria	Bacteria found in the intestinal tracts of all warm-blooded animals or mammals. Their presence in water is an indicator of pollution and possible contamination by pathogens (also see Coliform Bacteria).

Fecal Streptococci	A species of spherical bacteria including pathogenic strains found in the intestines of warm-blooded animals.
Feedback Loop	In the context of watershed management planning, a feedback loop is a process that provides for tracking progress toward goals and revising actions according to that progress.
Fixed-Location Monitoring	Sampling or measuring environmental conditions continuously or repeatedly at the same location.
Flow	See Discharge.
Fluvial	In fisheries, this describes fish whose life history takes place entirely in streams but migrate to smaller streams for spawning.
Focal	Critical areas supporting a mosaic of high quality habitats that sustain a diverse or unusually productive complement of native species.
Fully Supporting	In compliance with water quality standards and within the range of biological reference conditions for all designated and exiting beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2000).
Fully Supporting Cold Water	Reliable data indicate functioning, sustainable cold water biological assemblages (e.g., fish, macroinvertebrates, or algae), none of which have been modified significantly beyond the natural range of reference conditions (EPA 1997).
Fully Supporting but Threatened	An intermediate assessment category describing water bodies that fully support beneficial uses, but have a declining trend in water quality conditions, which if not addressed, will lead to a “not fully supporting” status.
Geographical Information Systems (GIS)	A georeferenced database.

Geometric Mean	A back-transformed mean of the logarithmically transformed numbers often used to describe highly variable, right-skewed data (a few large values), such as bacterial data.
Grab Sample	A single sample collected at a particular time and place. It may represent the composition of the water in that water column.
Gradient	The slope of the land, water, or streambed surface.
Ground Water	Water found beneath the soil surface saturating the layer in which it is located. Most ground water originates as rainfall, is free to move under the influence of gravity, and usually emerges again as stream flow.
Growth Rate	A measure of how quickly something living will develop and grow, such as the amount of new plant or animal tissue produced per a given unit of time, or number of individuals added to a population.
Habitat	The living place of an organism or community.
Headwater	The origin or beginning of a stream.
Hydrologic Basin	The area of land drained by a river system, a reach of a river and its tributaries in that reach, a closed basin, or a group of streams forming a drainage area (also see Watershed).
Hydrologic Cycle	The cycling of water from the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Atmospheric moisture, clouds, rainfall, runoff, surface water, ground water, and water infiltrated in soils are all part of the hydrologic cycle.

Hydrologic Unit — One of a nested series of numbered and named watersheds arising from a national standardization of watershed delineation. The initial 1974 effort (USGS 1987) described four levels (region, subregion, accounting unit, cataloging unit) of watersheds throughout the United States. The fourth level is uniquely identified by an eight-digit code built of two-digit fields for each level in the classification. Originally termed a cataloging unit, fourth field hydrologic units have been more commonly called subbasins. Fifth and sixth field hydrologic units have since been delineated for much of the country and are known as watershed and subwatersheds, respectively.

Hydrologic Unit Code (HUC) — The number assigned to a hydrologic unit. Often used to refer to fourth field hydrologic units.

Hydrology — The science dealing with the properties, distribution, and circulation of water.

Impervious — Describes a surface, such as pavement, that water cannot penetrate.

Influent — A tributary stream.

Inorganic — Materials not derived from biological sources.

Instantaneous — A condition or measurement at a moment (instant) in time.

Intergravel Dissolved Oxygen — The concentration of dissolved oxygen within spawning gravel. Consideration for determining spawning gravel includes species, water depth, velocity, and substrate.

Intermittent Stream — 1) A stream that flows only part of the year, such as when the ground water table is high or when the stream receives water from springs or from surface sources such as melting snow in mountainous areas. The stream ceases to flow above the streambed when losses from evaporation or seepage exceed the available stream flow. 2) A stream that has a period of zero flow for at least one week during most years.

Interstate Waters	Waters that flow across or form part of state or international boundaries, including boundaries with Indian nations.
Irrigation Return Flow	Surface (and subsurface) water that leaves a field following the application of irrigation water and eventually flows into streams.
Key Watershed	A watershed that has been designated in Idaho Governor Batt's *State of Idaho Bull Trout Conservation Plan* (1996) as critical to the long-term persistence of regionally important trout populations.
Knickpoint	Any interruption or break of slope.
Land Application	A process or activity involving application of wastewater, surface water, or semi-liquid material to the land surface for the purpose of treatment, pollutant removal, or ground water recharge.
Limiting Factor	A chemical or physical condition that determines the growth potential of an organism. This can result in a complete inhibition of growth, but typically results in less than maximum growth rates.
Limnology	The scientific study of fresh water, especially the history, geology, biology, physics, and chemistry of lakes.
Load Allocation (LA)	A portion of a water body's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).
Load(ing)	The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.
Loading Capacity (LC)	A determination of how much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, and a margin of safety, it becomes a total maximum daily load.

Loam	Refers to a soil with a texture resulting from a relative balance of sand, silt, and clay. This balance imparts many desirable characteristics for agricultural use.
Loess	A uniform wind-blown deposit of silty material. Silty soils are among the most highly erodible.
Lotic	An aquatic system with flowing water such as a brook, stream, or river where the net flow of water is from the headwaters to the mouth.
Luxury Consumption	A phenomenon in which sufficient nutrients are available in either the sediments or the water column of a water body, such that aquatic plants take up and store an abundance in excess of the plants' current needs.
Macroinvertebrate	An invertebrate animal (without a backbone) large enough to be seen without magnification and retained by a 500µm mesh (U.S. #30) screen.
Macrophytes	Rooted and floating vascular aquatic plants, commonly referred to as water weeds. These plants usually flower and bear seeds. Some forms, such as duckweed and coontail (*Ceratophyllum sp.*), are free-floating forms not rooted in sediment.
Margin of Safety (MOS)	An implicit or explicit portion of a water body's loading capacity set aside to allow the uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. This is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution.
Mass Wasting	A general term for the down slope movement of soil and rock material under the direct influence of gravity.
Mean	Describes the central tendency of a set of numbers. The arithmetic mean (calculated by adding all items in a list, then dividing by the number of items) is the statistic most familiar to most people.

Median	The middle number in a sequence of numbers. If there are an even number of numbers, the median is the average of the two middle numbers. For example, 4 is the median of 1, 2, 4, 14, 16; and 6 is the median of 1, 2, 5, 7, 9, 11.
Metric	1) A discrete measure of something, such as an ecological indicator (e.g., number of distinct taxon). 2) The metric system of measurement.
Milligrams per Liter (mg/l)	A unit of measure for concentration in water, essentially equivalent to parts per million (ppm).
Million gallons per day (MGD)	A unit of measure for the rate of discharge of water, often used to measure flow at wastewater treatment plants. One MGD is equal to 1.547 cubic feet per second.
Miocene	Of, relating to, or being an epoch of, the Tertiary between the Pliocene and the Oligocene periods, or the corresponding system of rocks.
Monitoring	A periodic or continuous measurement of the properties or conditions of some medium of interest, such as monitoring a water body.
Mouth	The location where flowing water enters into a larger water body.
National Pollution Discharge Elimination System (NPDES)	A national program established by the Clean Water Act for permitting point sources of pollution. Discharge of pollution from point sources is not allowed without a permit.
Natural Condition	A condition indistinguishable from that without human-caused disruptions.
Nitrogen	An element essential to plant growth, and thus is considered a nutrient.
Nodal	Areas that are separated from focal and adjunct habitats, but serve critical life history functions for individual native fish.

Nonpoint Source	A dispersed source of pollutants, generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and non-irrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.
Not Assessed (NA)	A concept and an assessment category describing water bodies that have been studied, but are missing critical information needed to complete an assessment.
Not Attainable	A concept and an assessment category describing water bodies that demonstrate characteristics that make it unlikely that a beneficial use can be attained (e.g., a stream that is dry but designated for salmonid spawning).
Not Fully Supporting	Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2000).
Not Fully Supporting Cold Water	At least one biological assemblage has been significantly modified beyond the natural range of its reference condition (EPA 1997).
Nuisance	Anything which is injurious to the public health or an obstruction to the free use, in the customary manner, of any waters of the state.
Nutrient	Any substance required by living things to grow. An element or its chemical forms essential to life, such as carbon, oxygen, nitrogen, and phosphorus. Commonly refers to those elements in short supply, such as nitrogen and phosphorus, which usually limit growth.
Nutrient Cycling	The flow of nutrients from one component of an ecosystem to another, as when macrophytes die and release nutrients that become available to algae (organic to inorganic phase and return).

Oligotrophic	The Greek term for "poorly nourished." This describes a body of water in which productivity is low and nutrients are limiting to algal growth, as typified by low algal density and high clarity.
Organic Matter	Compounds manufactured by plants and animals that contain principally carbon.
Orthophosphate	A form of soluble inorganic phosphorus most readily used for algal growth.
Oxygen-Demanding Materials	Those materials, mainly organic matter, in a water body which consume oxygen during decomposition.
Parameter	A variable, measurable property whose value is a determinant of the characteristics of a system; e.g., temperature, dissolved oxygen, and fish populations are parameters of a stream or lake.
Partitioning	The sharing of limited resources by different races or species; use of different parts of the habitat, or the same habitat at different times. Also the separation of a chemical into two or more phases, such as partitioning of phosphorus between the water column and sediment.
Pathogens	Disease-producing organisms (e.g., bacteria, viruses, parasites).
Perennial Stream	A stream that flows year-around in most years.
Periphyton	Attached microflora (algae and diatoms) growing on the bottom of a water body or on submerged substrates, including larger plants.
Pesticide	Substances or mixtures of substances intended for preventing, destroying, repelling, or mitigating any pest. Also, any substance or mixture intended for use as a plant regulator, defoliant, or desiccant.
pH	The negative $\log_{10}$ of the concentration of hydrogen ions, a measure which in water ranges from very acid (pH=1) to very alkaline (pH=14). A pH of 7 is neutral. Surface waters usually measure between pH 6 and 9.

Phased TMDL — A total maximum daily load (TMDL) that identifies interim load allocations and details further monitoring to gauge the success of management actions in achieving load reduction goals and the effect of actual load reductions on the water quality of a water body. Under a phased TMDL, a refinement of load allocations, waste load allocations, and the margin of safety is planned at the outset.

Phosphorus — An element essential to plant growth, often in limited supply, and thus considered a nutrient.

Physiochemical — In the context of bioassessment, the term is commonly used to mean the physical and chemical factors of the water column that relate to aquatic aquatic life. Examples in bioassessment usage include saturation of dissolved gases, temperature, pH, conductivity, dissolved or suspended solids, forms of nitrogen, and phosphorus. This term is used interchangeable with the terms "physical/chemical" and "physicochemical."

Plankton — Microscopic algae (phytoplankton) and animals (zooplankton) that float freely in open water of lakes and oceans.

Point Source — A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater.

Pollutant — Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Pollution — A very broad concept that encompasses human-caused changes in the environment which alter the functioning of natural processes and produce undesirable environmental and health effects. This includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.

Population	A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area.
Pretreatment	The reduction in the amount of pollutants, elimination of certain pollutants, or alteration of the nature of pollutant properties in wastewater prior to, or in lieu of, discharging or otherwise introducing such wastewater into a publicly owned wastewater treatment plant.
Primary Productivity	The rate at which algae and macrophytes fix carbon dioxide using light energy. Commonly measured as milligrams of carbon per square meter per hour.
Protocol	A series of formal steps for conducting a test or survey.
Qualitative	Descriptive of kind, type, or direction.
Quality Assurance (QA)	A program organized and designed to provide accurate and precise results. Included are the selection of proper technical methods, tests, or laboratory procedures; sample collection and preservation; the selection of limits; data evaluation; quality control; and personnel qualifications and training. The goal of QA is to assure the data provided are of the quality needed and claimed (Rand 1995, EPA 1996).
Quality Control (QC)	Routine application of specific actions required to provide information for the quality assurance program. Included are standardization, calibration, and replicate samples. QC is implemented at the field or bench level (Rand 1995, EPA 1996).
Quantitative	Descriptive of size, magnitude, or degree.
Reach	A stream section with fairly homogenous physical characteristics.
Reconnaissance	An exploratory or preliminary survey of an area.
Reference	A physical or chemical quantity whose value is known, and thus is used to calibrate or standardize instruments.

Reference Condition	1) A condition that fully supports applicable beneficial uses with little affect from human activity and represents the highest level of support attainable. 2) A benchmark for populations of aquatic ecosystems used to describe desired conditions in a biological assessment and acceptable or unacceptable departures from them. The reference condition can be determined through examining regional reference sites, historical conditions, quantitative models, and expert judgment (Hughes 1995).
Reference Site	A specific locality on a water body that is minimally impaired and is representative of reference conditions for similar water bodies.
Representative Sample	A portion of material or water that is as similar in content and consistency as possible to that in the larger body of material or water being sampled.
Resident	A term that describes fish that do not migrate.
Respiration	A process by which organic matter is oxidized by organisms, including plants, animals, and bacteria. The process converts organic matter to energy, carbon dioxide, water, and lesser constituents.
Riffle	A relatively shallow, gravelly area of a streambed with a locally fast current, recognized by surface choppiness. Also an area of higher streambed gradient and roughness.
Riparian	Associated with aquatic (stream, river, lake) habitats. Living or located on the bank of a water body.
Riparian Habitat Conservation Area (RHCA)	A U.S. Forest Service description of land within the following number of feet up-slope of each of the banks of streams: - 300 feet from perennial fish-bearing streams - 150 feet from perennial non-fish-bearing streams - 100 feet from intermittent streams, wetlands, and ponds in priority watersheds.
River	A large, natural, or human-modified stream that flows in a defined course or channel, or a series of diverging and converging channels.

Runoff	The portion of rainfall, melted snow, or irrigation water that flows across the surface, through shallow underground zones (interflow), and through ground water to creates streams.
Sediments	Deposits of fragmented materials from weathered rocks and organic material that were suspended in, transported by, and eventually deposited by water or air.
Settleable Solids	The volume of material that settles out of one liter of water in one hour.
Species	1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category.
Spring	Ground water seeping out of the earth where the water table intersects the ground surface.
Stagnation	The absence of mixing in a water body.
Stenothermal	Unable to tolerate a wide temperature range.
Stratification	An Idaho Department of Environmental Quality classification method used to characterize comparable units (also called classes or strata).
Stream	A natural water course containing flowing water, at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.
Stream Order	Hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher order streams result from the joining of two streams of the same order.
Storm Water Runoff	Rainfall that quickly runs off the land after a storm. In developed watersheds the water flows off roofs and pavement into storm drains that may feed quickly and directly into the stream. The water often carries pollutants picked up from these surfaces.

Stressors	Physical, chemical, or biological entities that can induce adverse effects on ecosystems or human health.
Subbasin	A large watershed of several hundred thousand acres. This is the name commonly given to 4th field hydrologic units (also see Hydrologic Unit).
Subbasin Assessment (SBA)	A watershed-based problem assessment that is the first step in developing a total maximum daily load in Idaho.
Subwatershed	A smaller watershed area delineated within a larger watershed, often for purposes of describing and managing localized conditions. Also proposed for adoption as the formal name for 6th field hydrologic units.
Surface Fines	Sediments of small size deposited on the surface of a streambed or lake bottom. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 605 mm depending on the observer and methodology used. Results are typically expressed as a percentage of observation points with fine sediment.
Surface Runoff	Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants in rivers, streams, and lakes. Surface runoff is also called overland flow.
Surface Water	All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water.
Suspended Sediments	Fine material (usually sand size or smaller) that remains suspended by turbulence in the water column until deposited in areas of weaker current. These sediments cause turbidity and, when deposited, reduce living space within streambed gravels and can cover fish eggs or alevins.

Taxon	Any formal taxonomic unit or category of organisms (e.g., species, genus, family, order). The plural of taxon is taxa (Armantrout 1998).
Tertiary	An interval of geologic time lasting from 66.4 to 1.6 million years ago. It constitutes the first of two periods of the Cenozoic Era, the second being the Quaternary. The Tertiary has five subdivisions, which from oldest to youngest are the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs.
Thalweg	The center of a stream's current, where most of the water flows.
Threatened Species	Species, determined by the U.S. Fish and Wildlife Service, which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.
Total Maximum Daily Load (TMDL)	A TMDL is a water body's loading capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual bases. TMDL = Loading Capacity = Load Allocation + Waste Load Allocation + Margin of Safety. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.
Total Dissolved Solids	Dry weight of all material in solution in a water sample as determined by evaporating and drying filtrate.
Total Suspended Solids (TSS)	The dry weight of material retained on a filter after filtration. Filter pore size and drying temperature can vary. American Public Health Association Standard Methods (Greenborg, Clescevi, and Eaton 1995) call for using a filter of 2.0 micron or smaller; a 0.45 micron filter is also often used. This method calls for drying at a temperature of 103-105 °C.

Toxic Pollutants	Materials that cause death, disease, or birth defects in organisms that ingest or absorb them. The quantities and exposures necessary to cause these effects can vary widely.
Tributary	A stream feeding into a larger stream or lake.
Trophic State	The level of growth or productivity of a lake as measured by phosphorus content, chlorophyll *a* concentrations, amount (biomass) of aquatic vegetation, algal abundance, and water clarity.
Turbidity	A measure of the extent to which light passing through water is scattered by fine suspended materials. The effect of turbidity depends on the size of the particles (the finer the particles, the greater the effect per unit weight) and the color of the particles.
Vadose Zone	The unsaturated region from the soil surface to the ground water table.
Waste Load Allocation (WLA)	The portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Waste load allocations specify how much pollutant each point source may release to a water body.
Water Body	A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.
Water Column	Water between the interface with the air at the surface and the interface with the sediment layer at the bottom. The idea derives from a vertical series of measurements (oxygen, temperature, phosphorus) used to characterize water.
Water Pollution	Any alteration of the physical, thermal, chemical, biological, or radioactive properties of any waters of the state, or the discharge of any pollutant into the waters of the state, which will or is likely to create a nuisance or to render such waters harmful, detrimental, or injurious to public health, safety, or welfare; to fish and wildlife; or to domestic, commercial, industrial, recreational, aesthetic, or other beneficial uses.

Water Quality — A term used to describe the biological, chemical, and physical characteristics of water with respect to its suitability for a beneficial use.

Water Quality Criteria — Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, or industrial processes.

Water Quality Limited — A label that describes water bodies for which one or more water quality criterion is not met or beneficial uses are not fully supported. Water quality limited segments may or may not be on a 303(d) list.

Water Quality Limited Segment (WQLS) — Any segment placed on a state's 303(d) list for failure to meet applicable water quality standards, and/or is not expected to meet applicable water quality standards in the period prior to the next list. These segments are also referred to as "303(d) listed."

Water Quality Management Plan — A state or area-wide waste treatment management plan developed and updated in accordance with the provisions of the Clean Water Act.

Water Quality Modeling — The prediction of the response of some characteristics of lake or stream water based on mathematical relations of input variables such as climate, stream flow, and inflow water quality.

Water Quality Standards — State-adopted and EPA-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

Water Table — The upper surface of ground water; below this point, the soil is saturated with water.

Watershed — 1) All the land which contributes runoff to a common point in a drainage network, or to a lake outlet. Watersheds are infinitely nested, and any large watershed is composed of smaller "subwatersheds." 2) The whole geographic region which contributes water to a point of interest in a water body.

Water Body Identification Number (WBID)	A number that uniquely identifies a water body in Idaho ties in to the Idaho Water Quality Standards and GIS information.
Wetland	An area that is at least some of the time saturated by surface or ground water so as to support with vegetation adapted to saturated soil conditions. Examples include swamps, bogs, fens, and marshes.
Young of the Year	Young fish born the year captured, evidence of spawning activity.

Appendix A. Metric – English Unit Conversion Chart

	English Units	Metric Units	To Convert	Example
Distance	Miles (mi)	Kilometers (km)	1 mi = 1.61 km 1 km = 0.62 mi	3 mi = 4.83 km 3 km = 1.86 mi
Length	Inches (in) Feet (ft)	Centimeters (cm) Meters (m)	1 in = 2.54 cm 1 cm = 0.39 in 1 ft = 0.30 m 1 m = 3.28 ft	3 in = 7.62 cm 3 cm = 1.18 in 3 ft = 0.91 m 3 m = 9.84 ft
Area	Acres (ac) Square Feet (ft^2) Square Miles (mi^2)	Hectares (ha) Square Meters (m^2) Square Kilometers (km^2)	1 ac = 0.40 ha 1 ha = 2.47 ac 1 ft^2 = 0.09 m^2 1 m^2 = 10.76 ft^2 1 mi^2 = 2.59 km^2 1 km^2 = 0.39 mi^2	3 ac = 1.20 ha 3 ha = 7.41 ac 3 ft^2 = 0.28 m^2 3 m^2 = 32.29 ft^2 3 mi^2 = 7.77 km^2 3 km^2 = 1.16 mi^2
Volume	Gallons (g) Cubic Feet (ft^3)	Liters (l) Cubic Meters (m^3)	1 g = 3.78 l 1 l = 0.26 g 1 ft^3 = 0.03 m^3 1 m^3 = 35.32 ft^3	3 g = 11.35 l 3 l = 0.79 g 3 ft^3 = 0.09 m^3 3 m^3 = 105.94 ft^3
Flow Rate	Cubic Feet per Second (ft^3/sec)[1]	Cubic Meters per Second (m^3/sec)	1 ft^3/sec = 0.03 m^3/sec 1 m^3/sec = ft^3/sec	3 ft^3/sec = 0.09 m^3/sec 3 m^3/sec = 105.94 ft^3/sec
Concentration	Parts per Million (ppm)	Milligrams per Liter (mg/l)	1 ppm = 1 mg/l[2]	3 ppm = 3 mg/l
Weight	Pounds (lbs)	Kilograms (kg)	1 lb = 0.45 kg 1 kg = 2.20 lbs	3 lb = 1.36 kg 3 kg = 6.61 kg
Temperature	Fahrenheit (°F)	Celsius (°C)	°C = 0.55 (F - 32) °F = (C x 1.8) + 32	3 °F = -15.95 °C 3 ° C = 37.4 °F

[1] 1 ft^3/sec = 0.65 million gallons per day; 1 million gallons per day is equal to 1.55 ft^3/sec.

[2] The ratio of 1 ppm = 1 mg/l is approximate and is only accurate for water.

Appendix B. Water Body Identification Numbers

Table 1. Water Body Identification Numbers and their boundaries

Water Body	WBID No.	Boundaries
Mud Lake	1	
Medicine Lodge Creek	2	Indian Creek to Sinks
Indian Creek	3	Forks to Medicine Lodge Creek
Indian Creek, E. Fk.	4	Headwaters to Forks
Indian Creek, W. Fk.	5	Headwaters to Forks
Medicine Lodge Creek	6	Confluence of Edie Creek and Medicine Lodge Creek to confluence with Indian Creek
Middle Creek	7	Confluence of Dry Creek and Middle Creek to Medicine Lodge Creek
Water Body	**WBID No.**	**Boundaries**
Middle Creek	8	Headwaters to Dry Creek confluence
Dry Creek	9	Headwaters to Middle Creek
Edie Creek	10	Headwaters to Medicine Lodge Creek
Medicine Lodge Creek	11	Confluence of Warm Creek and Webber Creek to Confluence with Edie Creek
Irving Creek	12	Headwaters to Medicine Lodge Creek
Warm Creek	13	Headwaters to Confluence with Warm Creek
Divide Creek	14	Headwaters to Warm Creek
Horse Creek	15	Headwaters to Warm Creek
Fritz Creek	16	Headwaters to Medicine Lodge Creek
Webber Creek	17	Headwaters to Medicine Lodge Creek
Deep Creek	18	Headwaters to sinks
Blue Creek	19	Headwaters to sinks
Warm Springs Creek	20	Headwaters to sinks
Crooked Creek	21	Headwaters to sinks
Chandler Canyon	22	Headwaters to sinks

Appendix C. Depth Fines Data

Cumulative depth fines percentage composition for streams sampled within the Medicine Lodge Subbasin.

Figure 1. Crooked Creek Depth Fines for 2000, Lower Section

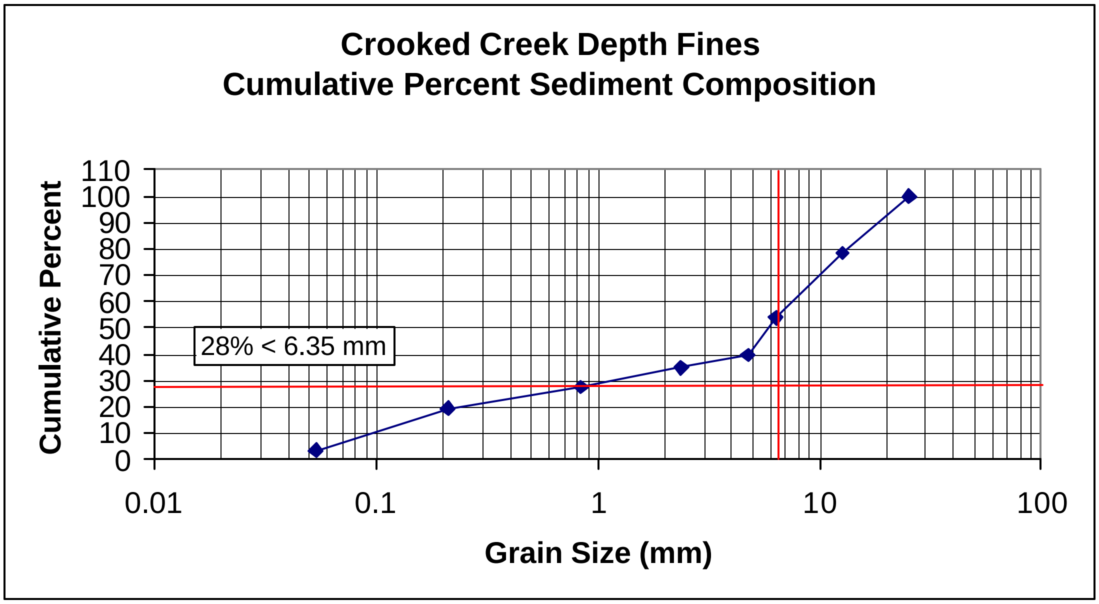


Figure 2. Deep Creek Depth Fines for 2000, Mid-section at Road Crossing

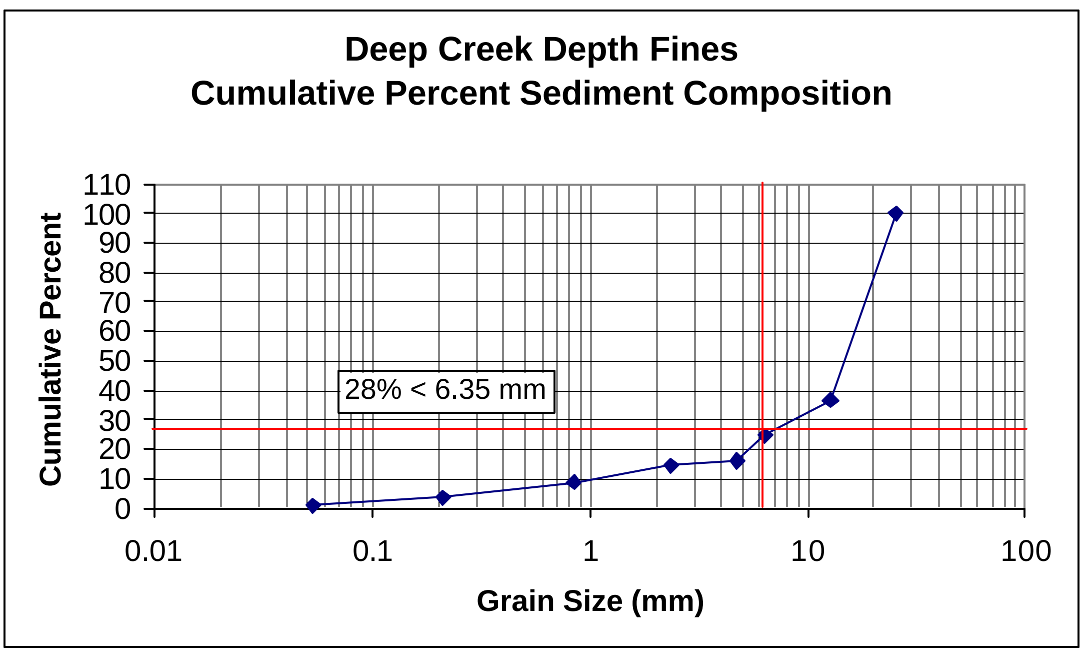


Figure 3. Edie Creek Depth Fines for 2000, Just Past BLM Boundary

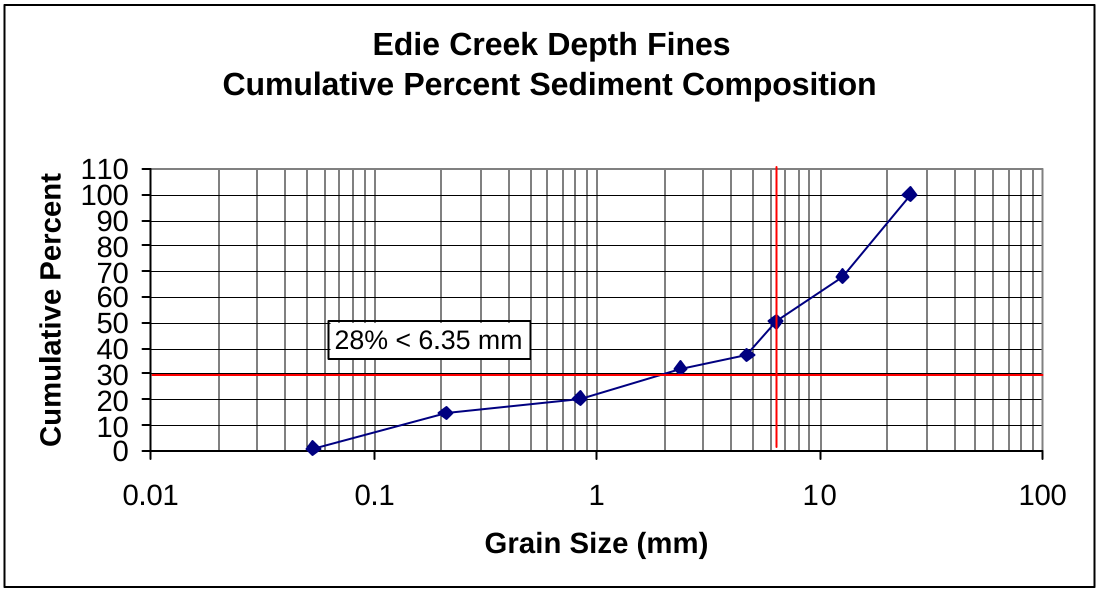


Figure 4. Fritz Creek Depth Fines for 2000, Just Below Forks

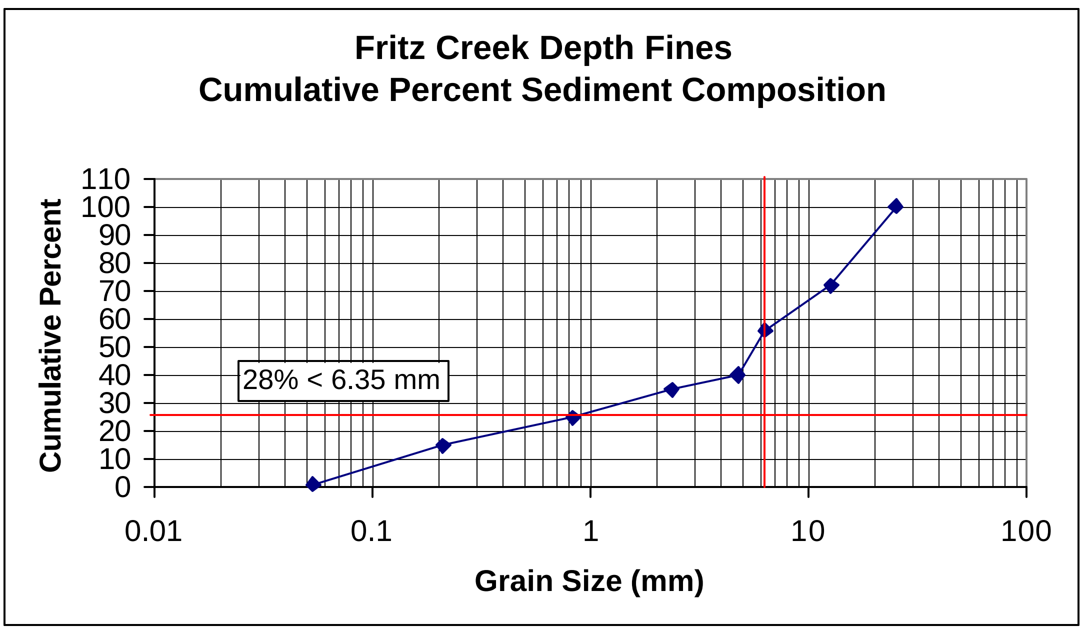


Figure 5. Irving Creek Depth Fines for 2000, Below Forks

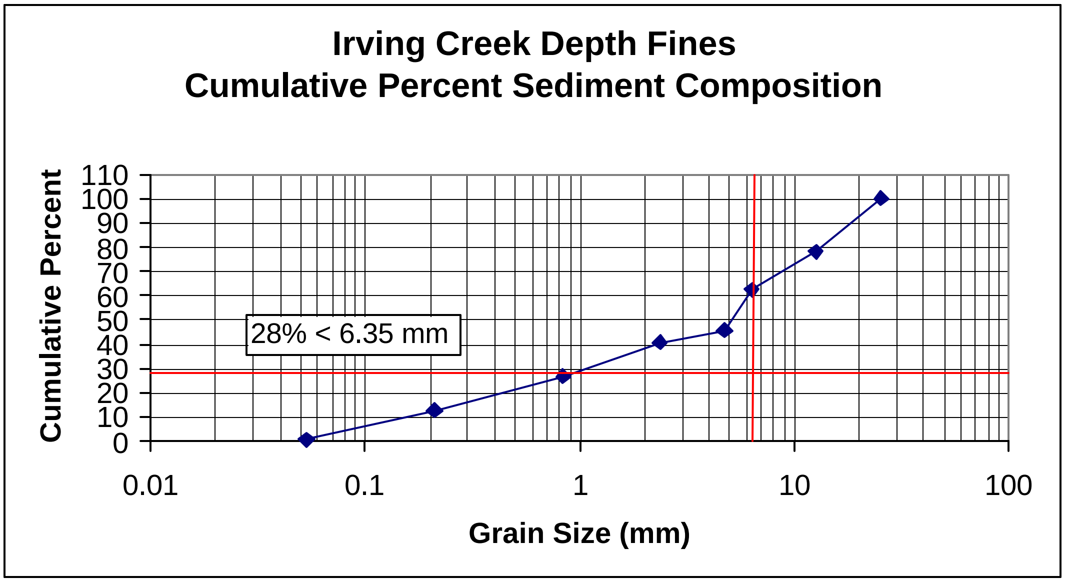


Figure 6. Medicine Lodge Creek Depth Fines for 2000, at Small, Idaho

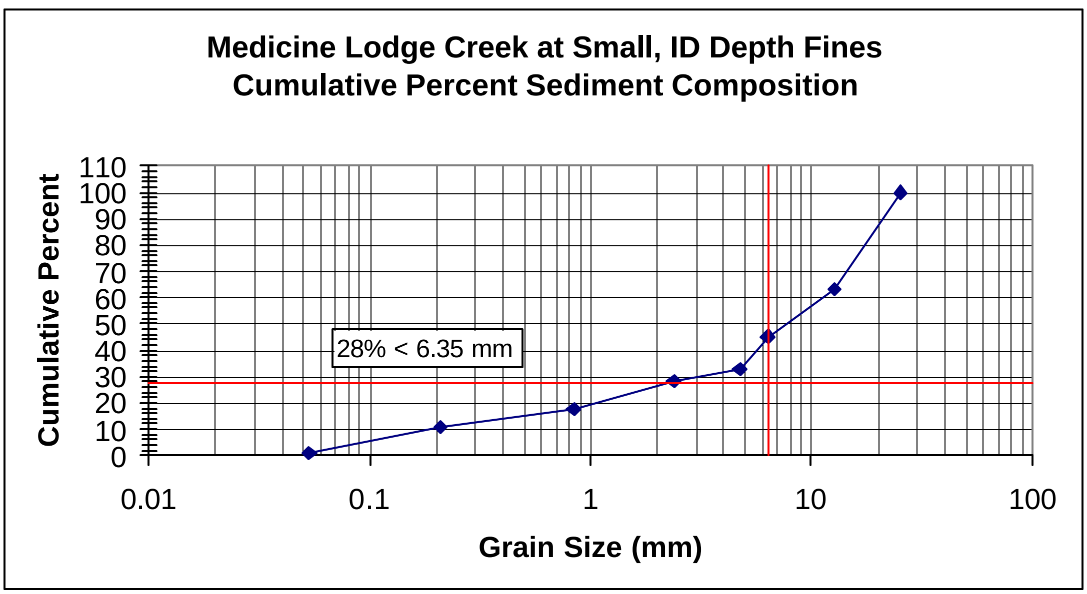


Figure 7. Medicine Lodge Creek Depth Fines for 2000, Mid-section

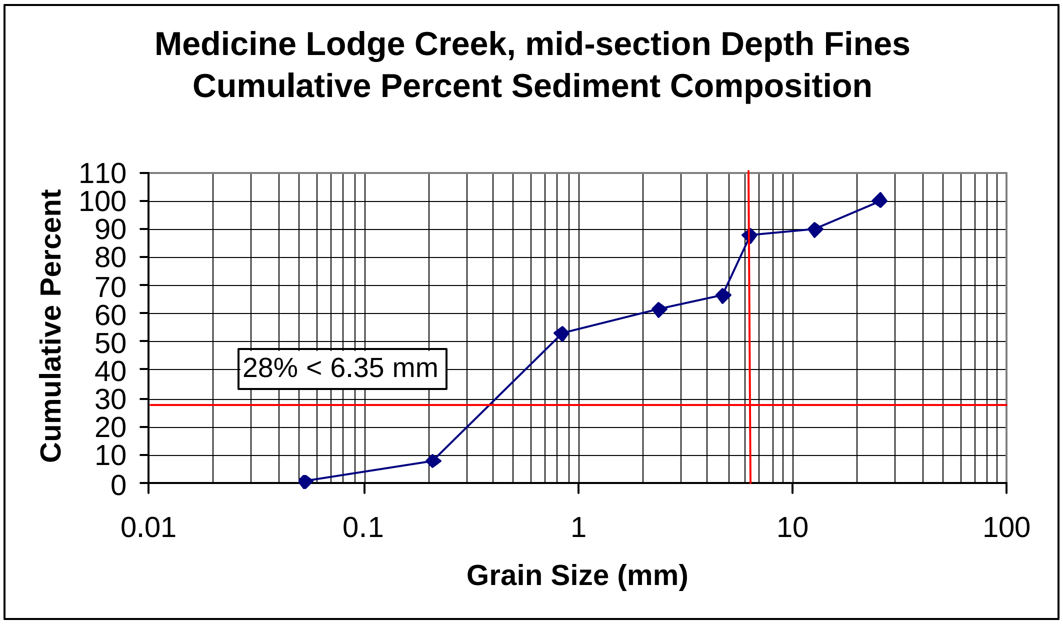


Figure 8. Middle Creek Depth Fines for 2000, Lower Section

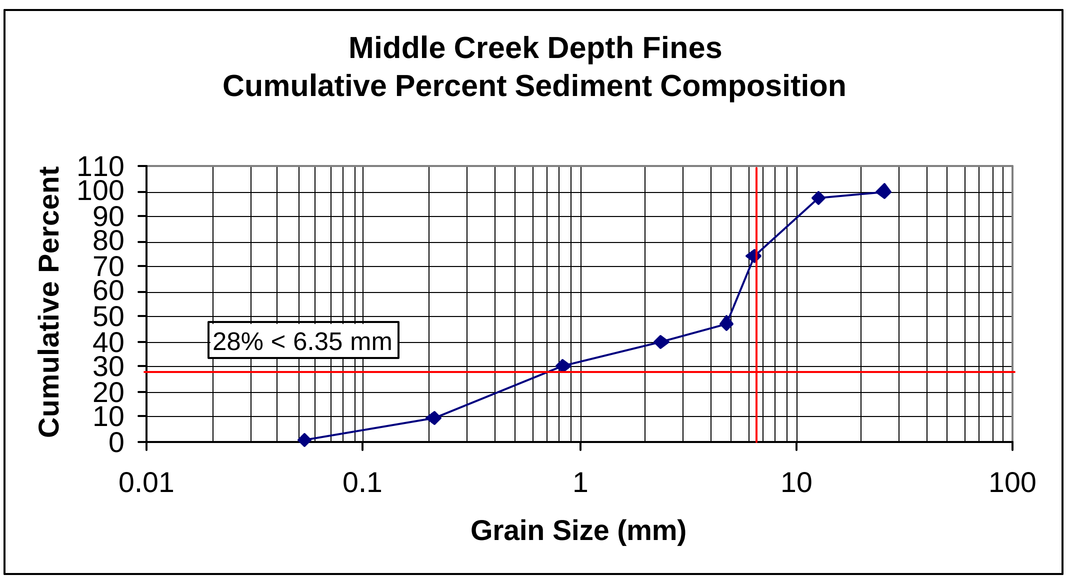


Figure 9. Warm Springs Creek Depth Fines for 2000, Road Crossing at Maud Mountain

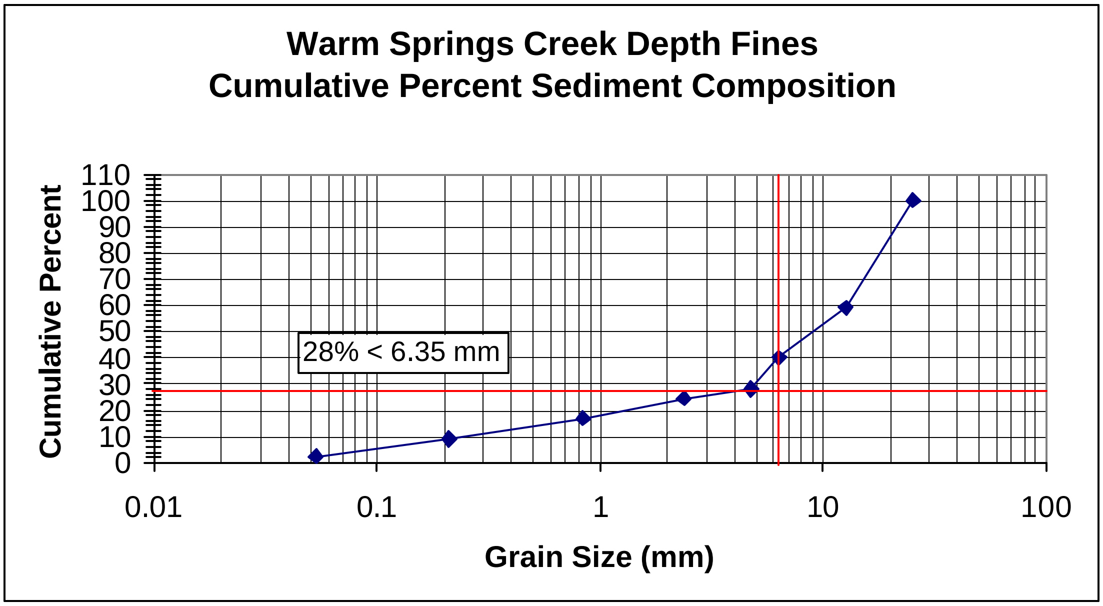


Figure 10. Webber Creek Depth Fines for 2000, Just Past USFS Boundary

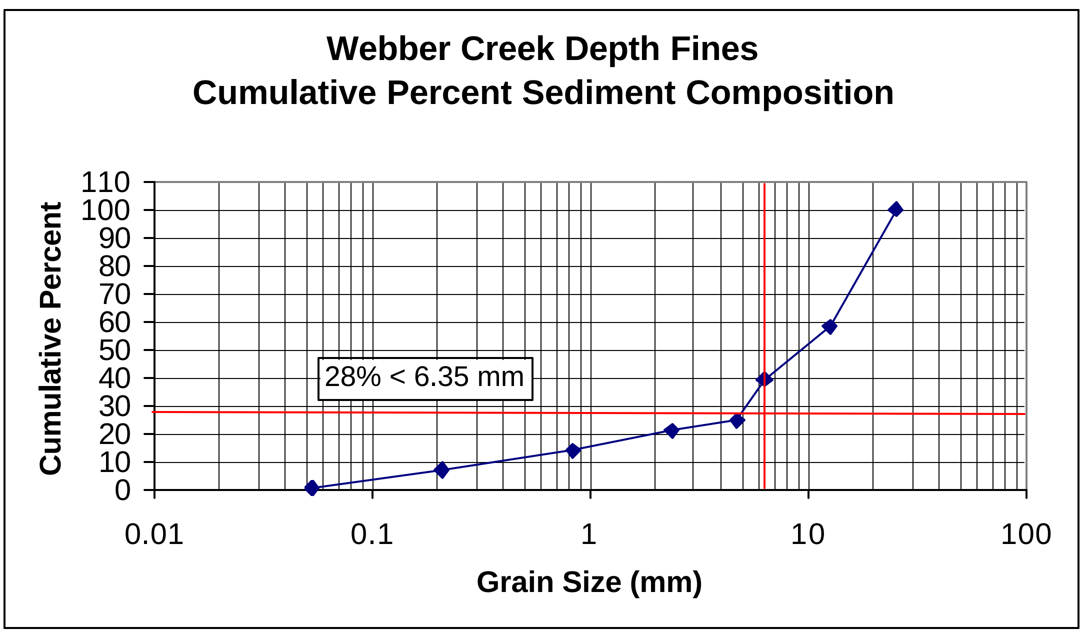


Figure 11. Edie Creek Depth Fines for 2001, 1.1 mi. up Edie Creek Road

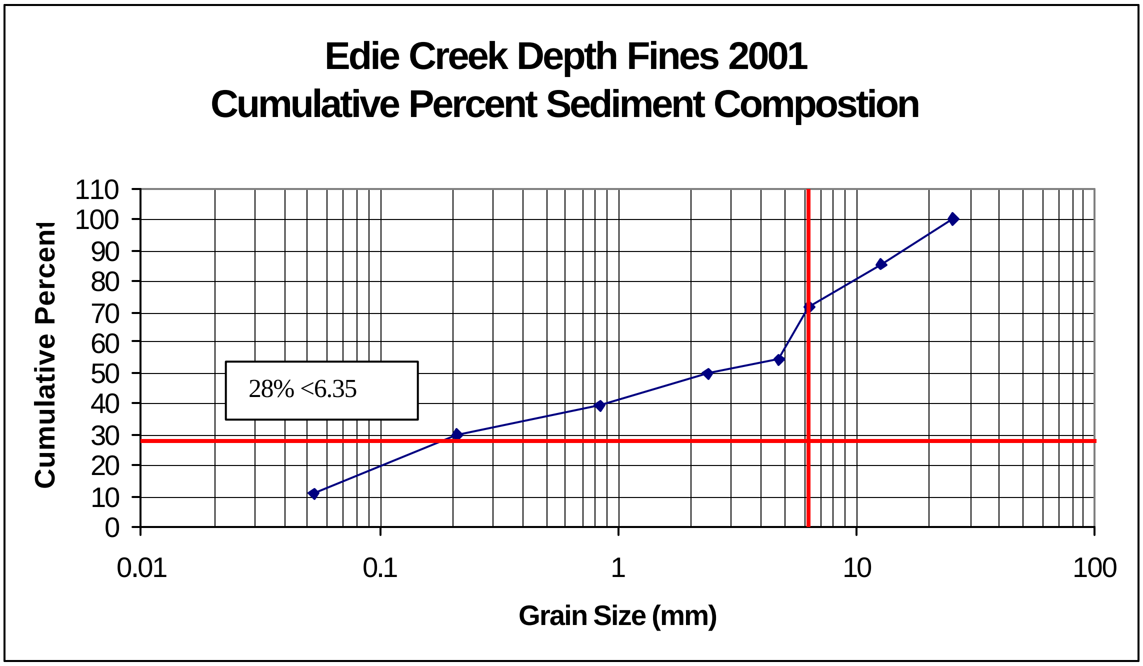


Figure 12. Edie Creek Depth Fines for 2001, Just Past BLM Boundary

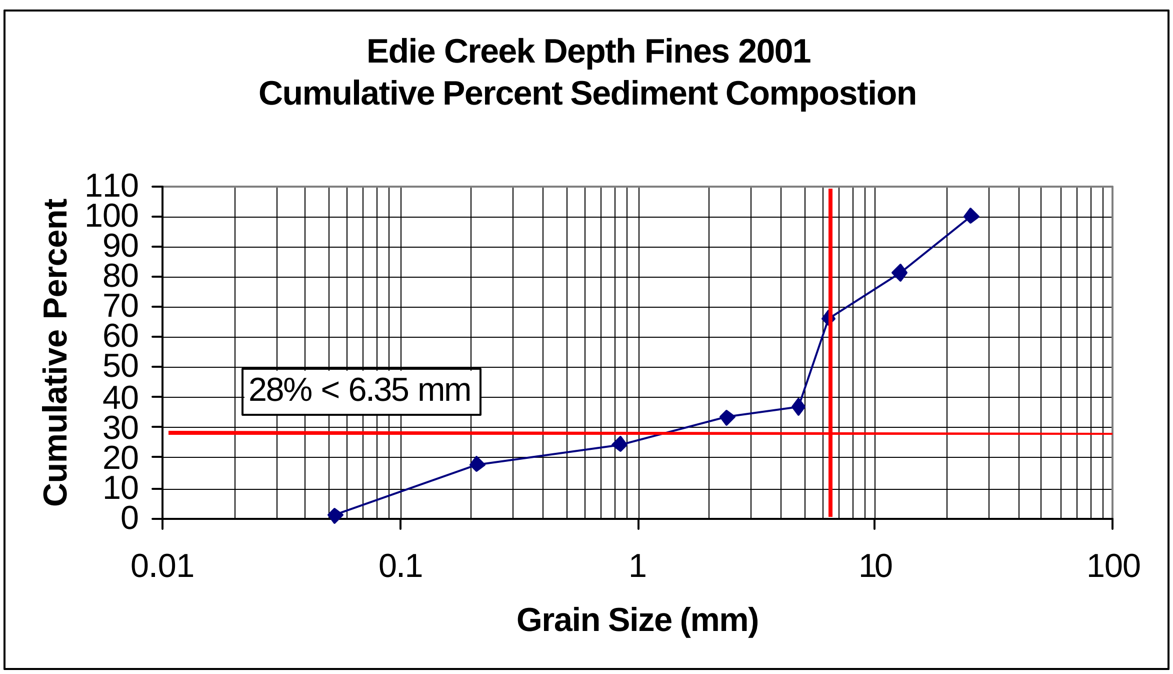


Figure 13. Irving Creek Depth Fines for 2001, Mouth

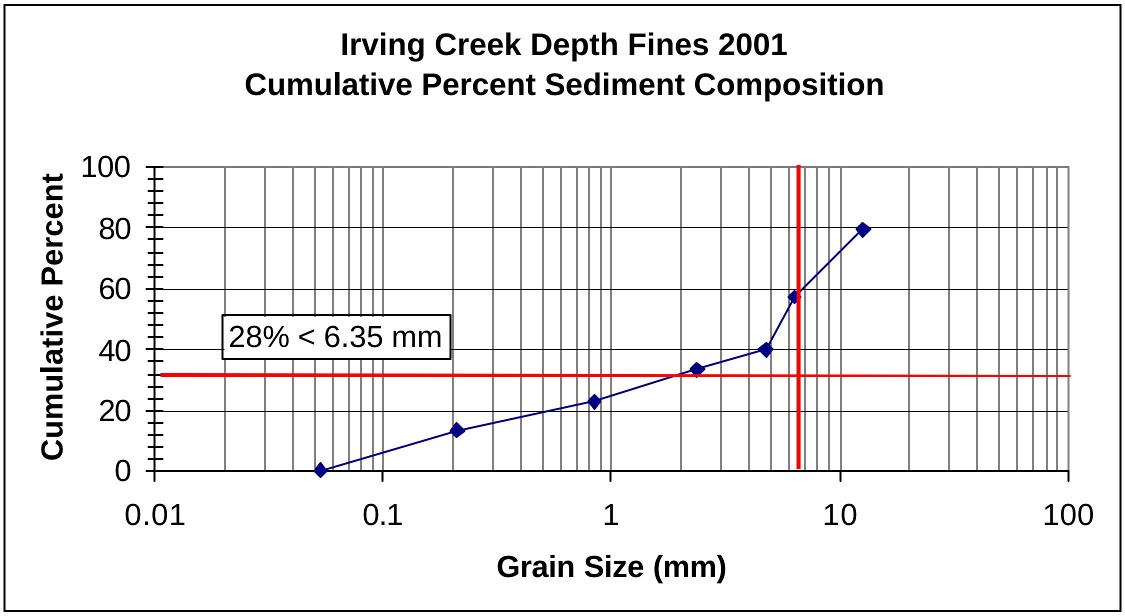


Figure 14. Irving Creek Depth Fines for 2001, East Fork on BLM

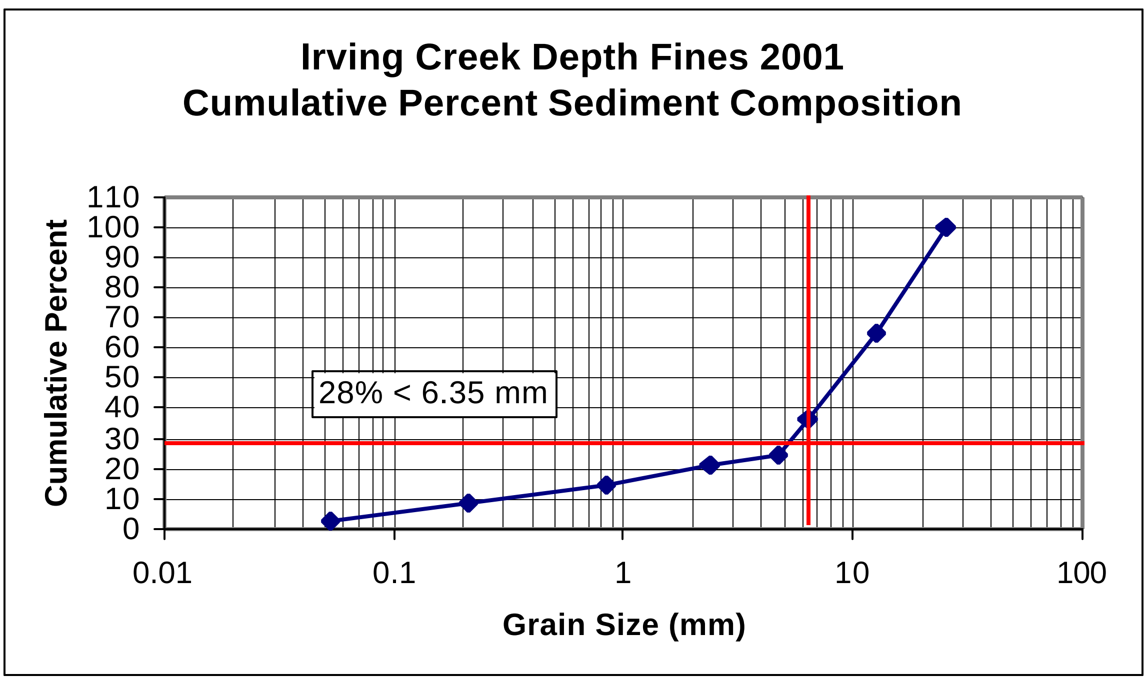


Figure 15. Irving Creek Depth Fines for 2001, Just Past BLM Boundary

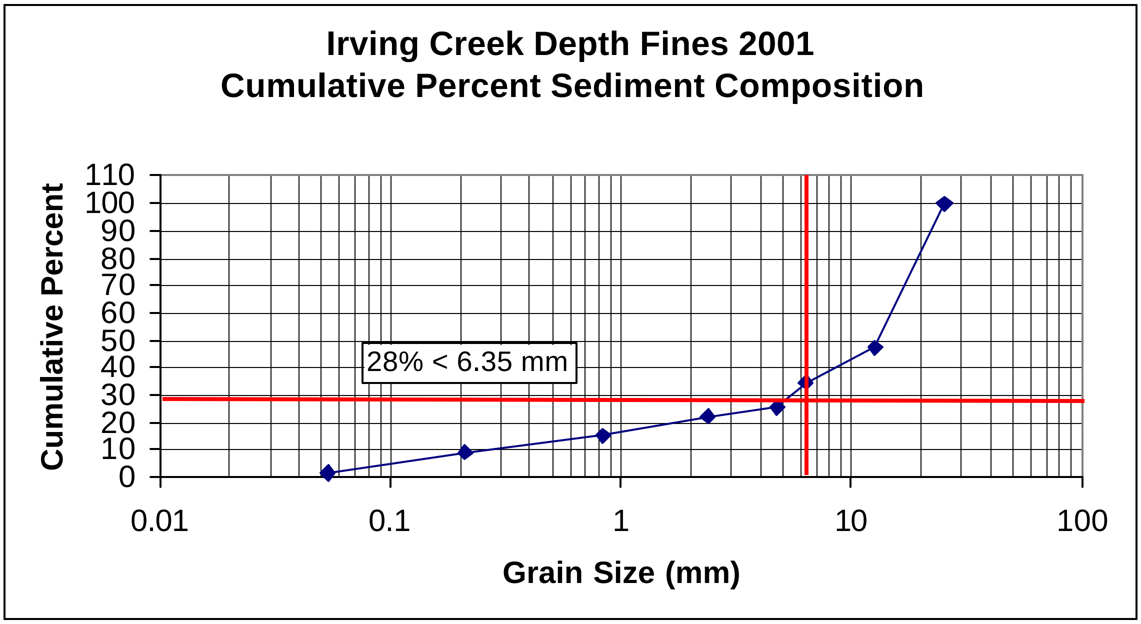


Figure 16. Irving Creek Depth Fines for 2001, High on USFS Land

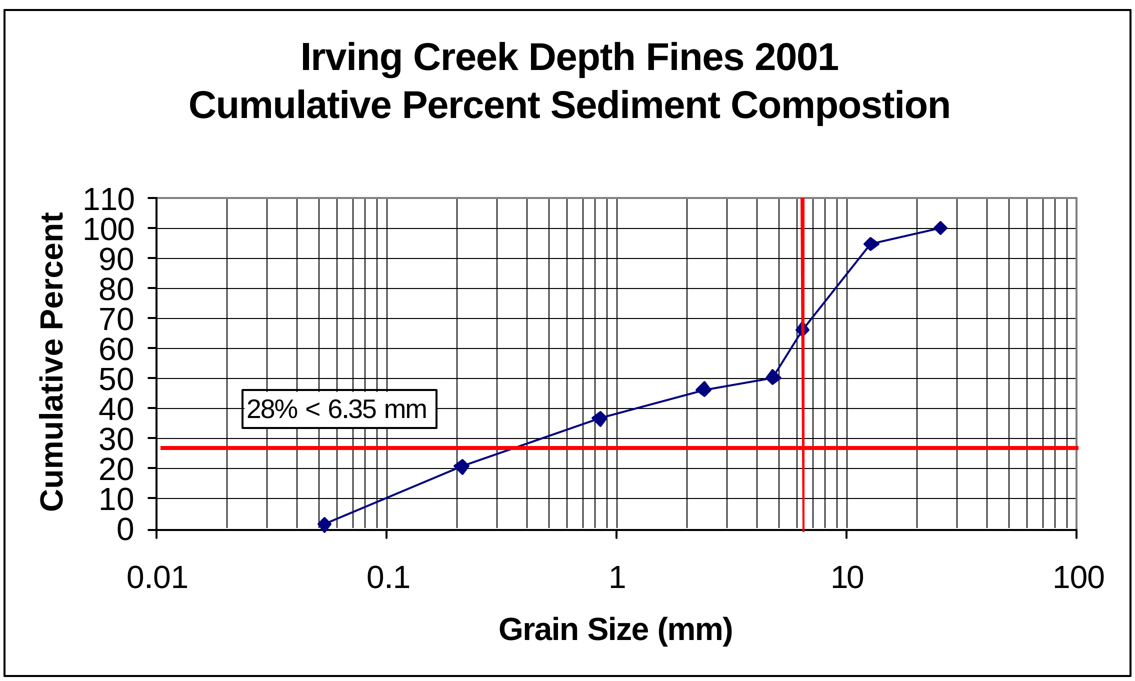


Figure 17. Middle Creek Depth Fines for 2001, High on USFS Land

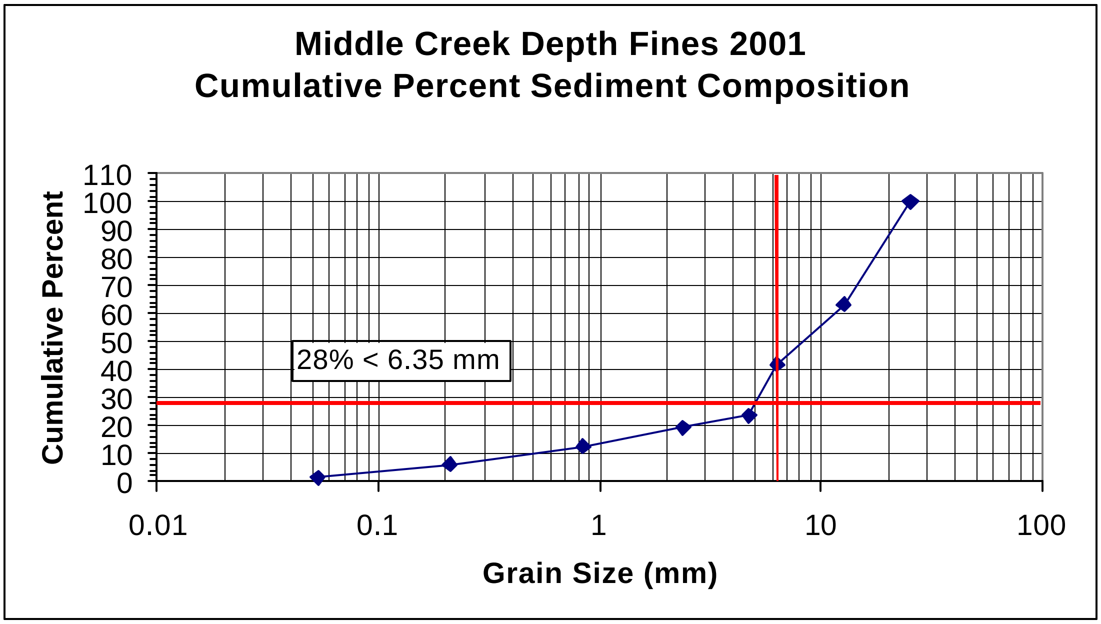


Figure 18. Warm Creek Depth Fines for 2001, Just Above Horse Creek

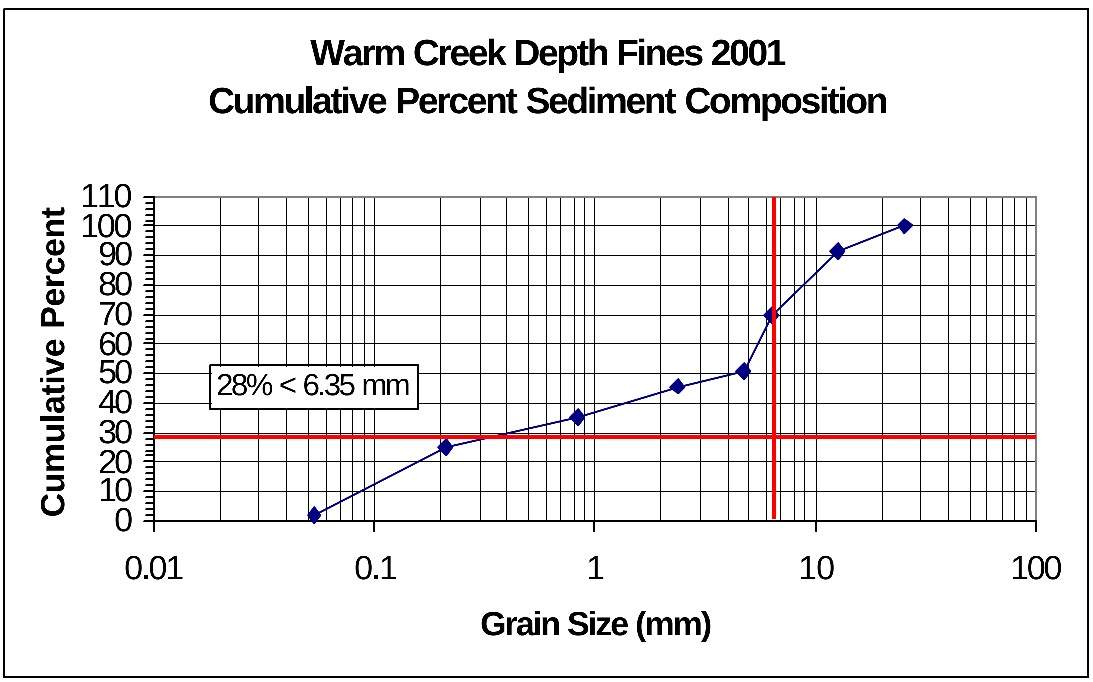


Figure 19. Webber Creek Depth Fines for 2001, At Bridge

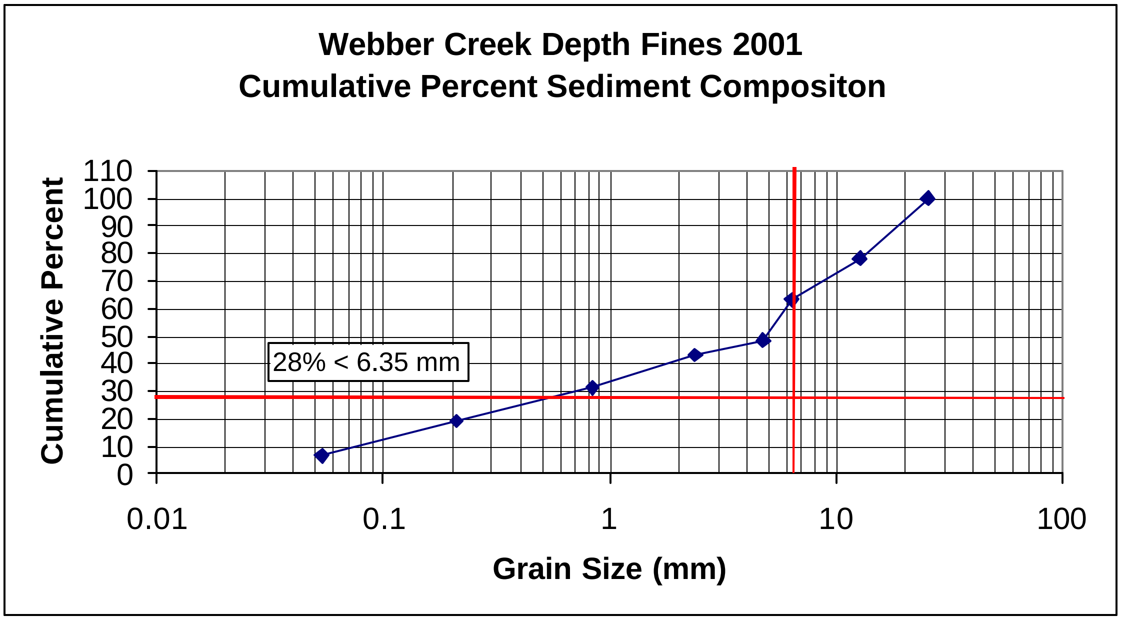


Figure 20. Webber Creek Depth Fines for 2001, At Campground

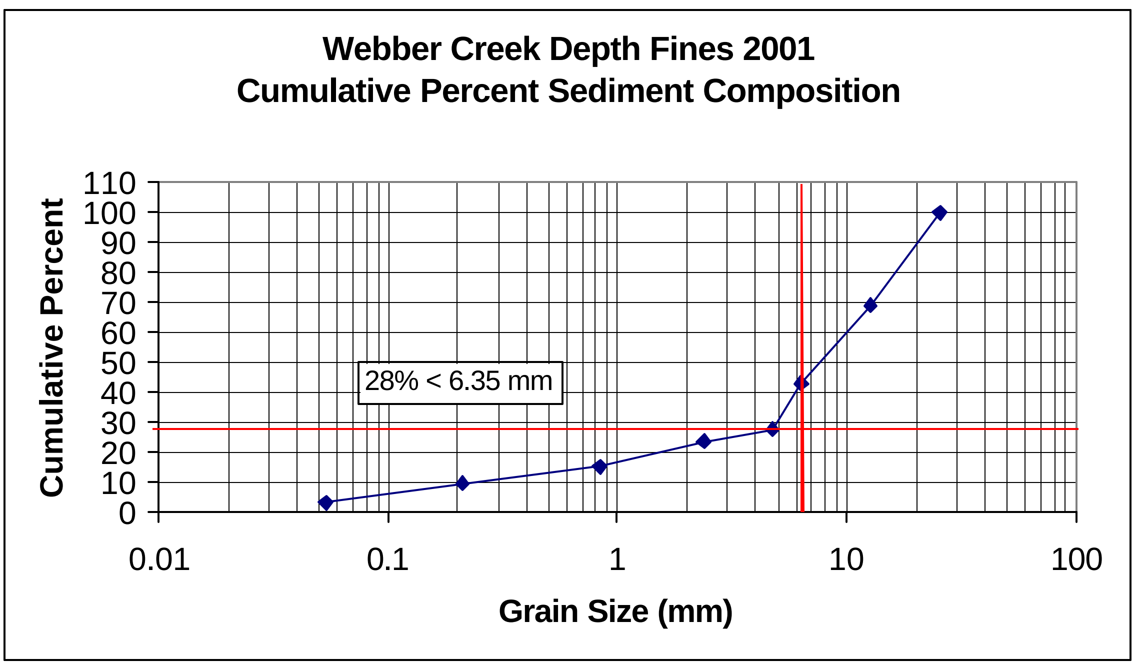
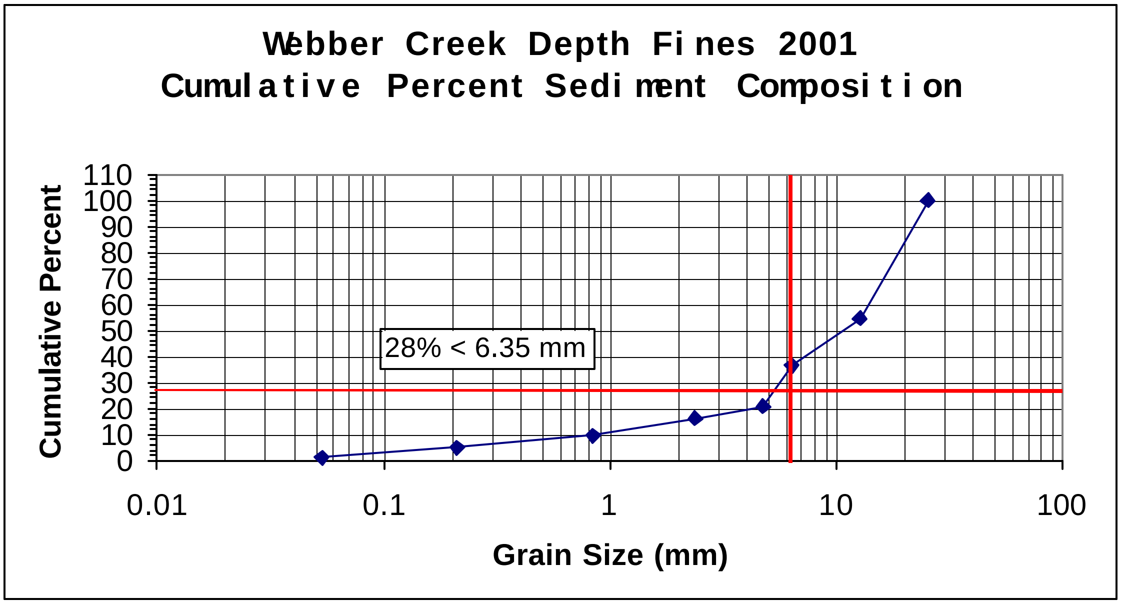


Figure 21. Webber Creek Depth Fines for 2001, Mouth



Appendix D. Streambank Erosion Inventory Methods and Results

Introduction

This appendix documents the analytical techniques and data used to develop the gross sediment budget and instream sediment measures used in calculating the sediment load allocations in this TMDL. The methods, data, and results for streambank erosion inventories and subsurface fine sediment data collection techniques are provided. These data are intended to:

1. characterize the natural and existing condition of the stream channels and riparian zones;
2. estimate the desired level of erosion and sedimentation; and
3. provide baseline data to track the effectiveness of TMDL implementation.

The streambank erosion inventories and sediment data collection techniques can be repeated and ultimately provide an adaptive management or feedback mechanism.

Streambank Erosion Inventory

The streambank erosion inventory used to estimate background and existing streambank erosion followed methods outlined in the proceedings from the Natural Resource Conservation Service (NRCS) Channel Evaluation Workshop (1983). Using the direct volume method, Edie Creek, Irving Creek, and Medicine Lodge Creek, listed in 1998 §303(d), were surveyed to determine the extent of chronic bank erosion and estimate the needed reductions.

The NRCS stream bank erosion inventory is a field method that estimates streambank/channel stability, length of active eroding banks, and bank geometry. The streambank/channel stability inventories were used to estimate the long-term lateral recession rate. The recession rate is determined from field evaluation of streambank characteristics that are assigned a categorical rating ranging from zero to three. The rating factors and rating scores are:

Bank Stability:

Do not appear to be eroding - 0
Erosion evident - 1
Erosion and cracking present - 2
Slumps and clumps sloughing off – 3

Bank Condition:

Some bare bank, few rills, no vegetative overhang - 0
Predominantly bare, some rills, moderate vegetative overhang - 1
Bare, rills, severe vegetative overhang, exposed roots - 2
Bare, rills and gullies, severe vegetative overhang, falling trees – 3

Vegetation / Cover On Banks:

Predominantly perennials or rock-covered - 0
Annuals / perennials mixed or about 40% bare - 1
Annuals or about 70% bare - 2
Predominantly bare – 3

Bank / Channel Shape:

V - shaped channel, sloped banks - 0
Steep V - shaped channel, near vertical banks - 1
Vertical banks, U - shaped channel - 2
U - shaped channel, undercut banks, meandering channel - 3

Channel Bottom:

Channel in bedrock / noneroding - 0
Soil bottom, gravels or cobbles, minor erosion - 1
Silt bottom, evidence of active downcutting – 2

Deposition:

No evidence of recent deposition - 1
Evidence of recent deposits, silt bars - 0

Cumulative Rating

Slight (0-4)	Moderate (5-8)	Severe (9+)

From the Cumulative Rating, the lateral recession rate is assigned.

0.01 - 0.05 feet per year	**Slight**
0.06 - 0.15 feet per year	**Moderate**
0.16 - 0.3 feet per year	**Severe**
0.5+ feet per year	**Very Severe**

Streambank stability can also be characterized through the following definitions. The corresponding streambank erosion condition ratings from Bank Stability or Bank Condition factors are included in italics.

Streambanks are considered stable if they do not show indications of any of the following features:

?? **Breakdown** - obvious blocks of bank broken away and lying adjacent to the bank breakage. *Bank Stability Rating 3*

?? **Slumping or false bank** - bank has obviously slipped down, cracks may or may not be obvious, but the slump feature is obvious. *Bank Stability Rating 2*

?? **Fracture** - a crack is visibly obvious on the bank indicating that blocks of the bank are about to slump or move into the stream. *Bank Stability Rating 2*

?? **Vertical and eroding** - the bank is mostly uncovered and the bank angle is steeper than 80 degrees from the horizontal. *Bank Stability Rating 1*

Streambanks are considered covered if they show any of the following features:

?? Perennial vegetation ground cover is greater than 50 percent. *Vegetation/Cover Rating 0*
?? Roots of vegetation cover more than 50 percent of the bank (deeply rooted plants such as willows and sedges provide such root cover). *Vegetation/Cover Rating 1*
?? At least 50 percent of the bank surfaces are protected by rocks of cobble size or larger. *Vegetation/Cover Rating 0*
?? At least 50 percent of the bank surfaces are protected by logs of 4-inch diameter or larger. *Vegetation/Cover Rating 1*

Streambank stability is estimated using a simplified modification of Platts and others (1983) as stated in *Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams* (Bauer and Burton 1993). The modification allows for measuring streambank stability in a more objective fashion. The lengths of banks on both sides of the stream throughout the entire linear distance of the representative reach are measured and proportioned into four stability classes as follows:

?? **Mostly covered and stable (non-erosional)** - streambanks are over 50 percent covered as defined above. Streambanks are stable as defined above. Banks associated with gravel bars having perennial vegetation above the scourline are in this category. *Cumulative Rating 0 - 4 (slight erosion) with a corresponding lateral recession rate of 0.01 - 0.05 feet per year.*
?? **Mostly covered and unstable (vulnerable)** - streambanks are over 50 percent covered as defined above. Streambanks are unstable as defined above. Such banks are typical of ? false banks" observed in meadows where breakdown, slumping, and/or fracture show instability yet vegetative cover is abundant. *Cumulative Rating 5 - 8 (moderate erosion) with a corresponding lateral recession rate of 0.06 - 0.2 feet per year.*
?? **Mostly uncovered and stable (vulnerable)** - streambanks are less than 50 percent covered as defined above. Streambanks are stable as defined above. Uncovered, stable banks are typical of streambanks trampled by concentrations of cattle. Such trampling flattens the bank so that slumping and breakdown do not occur even though vegetative cover is significantly reduced or eliminated. *Cumulative Rating 5 - 8 (moderate erosion) with a corresponding lateral recession rate of 0.06 - 0.2 feet per year.*
?? **Mostly uncovered and unstable (erosional)** - streambanks are less than 50% Covered as defined above. They are also Unstable as defined above. These are bare eroding streambanks and include ALL banks mostly uncovered, which are at a steep angle to the water surface. *Cumulative Rating 9+ (severe erosion) with a corresponding lateral recession rate of over 0.5 feet per year.*

Streambanks were inventoried to quantify bank erosion rate and annual average erosion. These data were used to develop a quantitative sediment budget to develop the load allocation.

Site Selection

The first step in the bank erosion inventory is to identify key problem areas. Streambank erosion tends to increase as a function of watershed area (NRCS 1983). As a result, the lower stream segments of larger watersheds tend to be problem areas. These stream segments tend to be alluvial streams commonly classified as response reaches, Rosgen (1996) B and C channel types.

Because it is often unrealistic to survey every stream segment, representative reaches were used and bank erosion rates are extrapolated over a larger stream segment. The length of the reach to be sampled is a function of stream type variability where streams segments with highly variable channel types need a large sample, whereas segments with uniform gradient and consistent geometry need less. The IDEQ typically inventories between 10 and 30 percent of streambank. Often, the location of some stream inventory reaches is more dependent on land ownership than watershed characteristics. For example, private landowners are sometimes unwilling to allow access to stream segments within their property.

Stream reaches are subdivided into sites with similar channel and bank characteristics. Breaks between sites are made where channel type and/or dominate bank characteristics change substantially. In a stream with uniform channel geometry, there may be only one site per stream reach, whereas in an area with variable conditions there may be several sites. The subdivision of stream reaches is at the discretion of the field crew leader.

Field Methods

Streambank erosion or channel stability inventory field methods were originally developed by the US Forest Service (Pfankuch 1975). Later inventory methods of channel stability are outlined in Lohrey (1989) and NRCS (1983). As stated above, the NRCS (1983) document outlines field methods used in this inventory. However, slight modifications to the field methods are documented.

Field crews typically consist of two to four people who are trained as a group to ensure quality control or consistent data collection. Field crews survey selected stream reaches measuring bank length, slope height, bankfull width and depth, and bank content. In most cases, a global positioning system (GPS) is used to locate the upper and lower boundaries of inventoried stream reaches. Additionally, while surveying field crews photograph essential problem areas.

Bank Erosion Calculations

The direct volume method is used to calculate average annual erosion rates for a given stream segment based on bank recession rate determined in the survey (NRCS 1983). The erosion rate (tons/mile/year) is used to estimate the total bank erosion of the selected stream corridor. The direct volume method is summarized in the following equations:

$$E = [A_E * R_{LR} * ?_B]/2000 \text{ (lbs/ton)}$$

where:

E = bank erosion over sampled stream reach (tons/yr/sample reach)

A_E = eroding area (ft^2)

R_{LR} = lateral recession rate (ft/yr)

? ? ? ? ? $?_B$ = bulk density of bank material (lbs/ft^3)

The bank erosion rate (E_R) is calculated by dividing the sampled bank erosion (E) by the total stream length sampled:

$$E_R = E/L_{BB}$$

where:

E_R = bank erosion rate (tons/mile/year)

E = bank erosion over sampled stream reach (tons/yr/sample reach)

L_{BB} = bank to bank stream length over sampled reach

Total bank erosion is expressed as an annual average. However, the frequency and magnitude of bank erosion events are greatly a function of soil moisture and stream discharge (Leopold and others 1964). Because channel erosion events typically result from above average flow events, the annual average bank erosion value is considered a long term average. For example, a 50-year flood event might cause five feet of bank erosion in one year and over a ten-year period this event accounts for the majority of bank erosion. These events have less of an influence where bank trampling is the major cause of channel instability.

The *eroding area* (A_E) is the product of linear horizontal bank distance and average bank slope height. Bank length and slope heights are measured while walking along the stream channel. Pacing is used to measure horizontal distance, and bank slope heights are continually measured and averaged over a given reach or site. The horizontal length is the length of the right or left bank, not both. Typically, one bank along the stream channel is actively eroding, as in the bank on the outside of a meander. However, both banks of channels with severe headcuts or gullies will be eroding and are to be measured separately and eventually summed.

Determining the *lateral recession rate* (R_{LR}) is one of the most critical factors in this methodology (NRCS 1983). To facilitate consistent data collection, the

NRCS developed rating factors used to estimate lateral recession rate. Similar to methods developed by Pfankuch (1975), the NRCS method measures bank and channel stability, and then uses the ratings as surrogates for bank erosion rates. The IDEQ developed recession rates using the NRCS methods.

The *bulk density* ($?_B$) of bank material is measured ocularly in the field. Soil bulk density is the weight of material divided by its volume, including the volume of its pore spaces. A table of typical soil bulk densities can be used, (NRCS 1983) or soil samples can be collected and soil bulk density measured in the laboratory. Copies of the streambank erosion inventory worksheets for Edie Creek, Irving Creek, and Medicine Lodge Creek are provided on the following pages.

Edie Creek Streambank Erosion Condition Inventory (November 2000)

Reach	Length (ft)	Stream Length (ft)	Bank Height (ft)	Soils	Bulk Density	Bank Stability	Bank Condition	Vegetation or Cover	Bank & Channel Shape	Channel Bottom	Deposition	Erosion Severity	Lateral Recession Rate (ft/yr)	Erosion Rate (Tons)
E1	2468	4936	1	silty clay loam	87.4	1	0.5	0.5	0.5	1	0.5	**Slight**	**0.050**	**10.8**
E2	8230	16460	2	silty clay loam	87.4	1	0.5	0.5	1.5	1	0.5	**Slight**	**0.058**	**83.8**
E3	3227	6454	1	silty clay loam	87.4	3	1.5	0.5	2	1	0	**Moderate**	**0.201**	**56.7**
	2.6	Miles	Percent of stream with a Slight Erosion Problem					**18%**						**151.3**
			Percent of stream with a Moderate Erosion Problem					**82%**						
			Percent of stream with a Severe Erosion Problem					**0%**						
					Total Percent of Stream assessed			100%						

Irving Creek Streambank Erosion Condition Inventory (November 2000)Remainder																		
Reach	Length (ft)	Stream Length (ft)	Bank Height (ft)	Soils	Bulk Density	Bank Stability	Bank Condition	Vegetation or Cover	Bank & Channel Shape	Channel Bottom	Deposition	Erosion Severity	Total	Slight Erosion Length	Moderate Erosion Length	Severe Erosion Length	Lateral Recession Rate (ft/yr)	Erosion Rate (Tons)
I1	12187	24374	2	silty clay loam	87.4	1	1.5	1	2	1.5	0.5	**Moderate**	7.5	0	12187	0	**0.171**	**364.8**
I2	2131	4262	4	silty clay loam	87.4	0.5	0.5	0	2	1.5	0	**Slight**	4.5	2131	0	0	**0.055**	**41.0**
I3	3411	6822	7	silty clay loam	87.4	1	1	1	2	1	0	**Moderate**	6.0	0	3411	0	**0.096**	**201.0**
EI	4475	8950	3	silty clay loam	87.4	1	0	0	2	1	0	**Slight**	4.0	4475	0	0	**0.050**	**58.7**
	4.2	Miles	Percent of stream with a Slight Erosion Problem					**30%**						**6606**	**15598**	**0**		**665.4**
			Percent of stream with a Moderate Erosion Problem					**70%**										
			Percent of stream with a Severe Erosion Problem					**0%**										
					Total Percent of Stream assessed			100%										

Medicine Lodge Creek Streambank Erosion Condition Inventory (June-August of 2000)-Eroding Banks																
Reach	Length (ft)	Bank Height (ft)	Soils	Bulk Density	Bank Stability	Bank Condition	Vegetation or Cover	Bank & Channel Shape	Channel Bottom	Deposition	Erosion Severity	Total	Slight Erosion Length	Moderate Erosion Length	Severe Erosion Length	Lateral Recession Rate (ft/yr)	Erosion Rate (Tons)
M1&M2	730	4.5	Sandy Loam	93.7	2	1.5	1	2	1	0.5	**Moderate**	8.0	0	730	0	**0.20**	**30.9**
M3	654	5	Sandy Loam	93.7	2	1	1	2	1	0	**Moderate**	7.0	0	654	0	**0.14**	**22.0**
M4-A	256	4.5	Silt Loam	87.4	3	1	1	3	1	0	**Severe**	9.0	0	0	256	**0.30**	**15.1**
M4-B&M5-A	245	4	Silt Loam	87.4	1	0	0	2	1	0	**Slight**	4.0	245	0	0	**0.05**	**2.1**
M6-A	150	4	Silt Loam	87.4	1	0	0	2	1	1	**Slight**	5.0	0	150	0	**0.06**	**1.5**
M6-B	660	5	Silt Loam	87.4	3	2	2	3	1	0	**Severe**	11.0	0	0	660	**0.37**	**52.9**
M7	491	2.5	Silt Loam	87.4	2	2	1	2	1	0	**Moderate**	8.0	0	491	0	**0.20**	**10.8**
M8-A	1,992	4	Silt Loam	87.4	3	2	2	3	1	1	**Severe**	12.0	0	0	1992	**0.40**	**139.3**
M8-C	675	3.5	Silt Loam	87.4	3	2	2	2	1	0	**Severe**	10.0	0	0	675	**0.33**	**34.4**
M9	100	5	Silt Loam	87.4	2	1	3	1	1	0	**Moderate**	8.0	0	**100**	0	**0.20**	**4.4**
M10-A	620	4	Silt Loam	87.4	3	2	1	2.5	1	0.5	**Severe**	10.0	0	0	620	**0.33**	**36.1**
M10-B	2,438	4	Silt Loam	87.4	2	2	3	2	2	0	**Severe**	11.0	0	0	2438	**0.37**	**156.3**
M11	936	3	Silt Loam	87.4	3	2	2	2	1	0	**Severe**	10.0	0	0	936	**0.33**	**40.9**
M12-A	480	4.5	Silt Loam	87.4	3	2	2	2	1	0	**Severe**	10.0	0	0	480	**0.33**	**31.5**
M12-B	1,593	4.5	Silt Loam	87.4	2	3	3	2	2	0	**Severe**	12.0	0	0	1593	**0.40**	**125.3**
M13	1,258	4.5	Silt Loam	87.4	3	1	1	2	1	1	**Severe**	9.0	0	0	1258	**0.30**	**74.2**

Medicine Lodge Creek Streambank Erosion Condition Inventory (June-August of 2000)-Eroding Banks

Reach	Length (ft)	Bank Height (ft)	Soils	Bulk Density	Bank Stability	Bank Condition	Vegetation or Cover	Bank & Channel Shape	Channel Bottom	Deposition	Erosion Severity	Total	Slight Erosion Length	Moderate Erosion Length	Severe Erosion Length	Lateral Recession Rate (ft/yr)	Erosion Rate (Tons)
M14	290	4.5	Silt Loam	87.4	3	1	1	2	1	0	**Moderate**	8.0	0	290	0	**0.20**	**11.5**
	2.6	Percent of stream with a Slight Erosion Problem					**2%**						**245**	**2415**	**10908**		**789.2**
		Percent of stream with a Moderate Erosion Problem					**18%**										
		Percent of stream with a Severe Erosion Problem					**80%**										
				Total Percent of Stream assessed			100%										

Medicine Lodge Creek Streambank Erosion Condition Inventory (June-August of 2000)-Rest of Banks

Reach	Length (ft)	Stream Length (ft)	Bank Height (ft)	Soils	Bulk Density	Bank Stability	Bank Condition	Vegetation or Cover	Bank & Channel Shape	Channel Bottom	Deposition	Erosion Severity	Total	Slight Erosion Length	Moderate Erosion Length	Severe Erosion Length	Lateral Recession Rate (ft/yr)	Erosion Rate (Tons)
M1&M2	8,939	17878	1.5	Sandy Loam	93.7	0.5	0.5	0	2	1	0.5	**Slight**	4.5	8939	0	0	**0.055**	**69**
M3	8,975	17950	2	Sandy Loam	93.7	0	0	0	2	1	0	**Slight**	3.0	8975	0	0	**0.040**	**67**
M4-A	2,173	4346	2.5	Silty Loam	87.4	3	1	1	3	1	0	**Severe**	9.0	0	0	2173	**0.300**	**142**
M4-B&M5-A	5,622	11244	2.5	Silty Loam	87.4	1	0	0	2	1	0	**Slight**	4.0	5622	0	0	**0.050**	**61**
M5-B	3,445	6890	1.5	Sandy Loam	93.7	0	1	0	0	0	0	**Slight**	1.0	3445	0	0	**0.020**	**10**
M6-A	6,846	13692	2.5	Silty Loam	87.4	1	0	0	2	1	1	**Slight**	5.0	0	6846	0	**0.058**	**87**
M6-B	8,514	17028	2.5	Silty Loam	87.4	0	0	0	3	1	0	**Slight**	4.0	8514	0	0	**0.050**	**93**
M7	7,509	15018	1	Silty Loam	87.4	0	0	1	1	1	0	**Slight**	3.0	7509	0	0	**0.040**	**26**
M8-A	5,004	10008	2.5	Silty Loam	87.4	2	0.5	0	2	1	1	**Moderate**	6.5	0	5004	0	**0.119**	**130**
M8-C	7,906	15812	2	Silty Loam	87.4	1	0	0	2	1	0	**Slight**	4.0	7906	0	0	**0.050**	**69**
M9	8,810	17620	2.5	Silty Loam	87.4	0	0	0	1	0	1	**Slight**	2.0	8810	0	0	**0.030**	**58**
M10-A	4,706	9412	2.5	Silty Loam	87.4	0.5	0	0	1	1	0.5	**Slight**	3.0	4706	0	0	**0.040**	**41**
M10-B	7,000	14000	2.5	Silty Loam	87.4	1	0.5	0	1	1	0	**Slight**	3.5	7000	0	0	**0.045**	**69**
M11	11,340	22680	1.5	Silty Loam	87.4	1	0	0	1	1	0	**Slight**	3.0	11340	0	0	**0.040**	**59**
M12-A	7,836	15672	2.5	Silty Loam	87.4	1	0	0	1	1	1	**Slight**	4.0	7836	0	0	**0.050**	**86**

Medicine Lodge Creek Streambank Erosion Condition Inventory (June-August of 2000)-Rest of Banks																			
Reach	Length (ft)	Stream Length (ft)	Bank Height (ft)	Soils	Bulk Density	Bank Stability	Bank Condition	Vegetation or Cover	Bank & Channel Shape	Channel Bottom	Deposition	Erosion Severity	Total	Slight Erosion Length	Moderate Erosion Length	Severe Erosion Length	Lateral Recession Rate (ft/yr)	Erosion Rate (Tons)
M12-B	6,807	13614	2.5	Silty Loam	87.4	2	0.5	0	2	2	0	**Moderate**	6.5	0	6807	0	**0.119**	**177**
M13	5,760	11520	2	Silty Loam	87.4	1	0	1	1	1	0	**Slight**	4.0	5760	0	0	**0.050**	**50**
M14	3,216	6432	2	Silty Loam	87.4	1	0	0	1	0	0	**Slight**	2.0	3216	0	0	**0.030**	**17**
M15	3,599	7198	1	Silty Loam	87.4	1	0	0	3	1	0	**Slight**	5.0	0	3599	0	**0.058**	**18**
M16	5,536	11072	1	Silty Loam	87.4	1	0	0	2	0	0	**Slight**	3.0	5536	0	0	**0.040**	**19**
M17	8,004	16008	1	Silty Loam	87.4	1	1	0	2	0	1	**Slight**	5.0	0	8004	0	**0.058**	**41**
M18	1,122	2244	1	Silty Loam	87.4	1	1	0.5	2	1	1	**Moderate**	6.5	0	1122	0	**0.119**	**12**
	26.3	Miles	Percent of stream with a Slight Erosion Problem					**76%**						**105114**	**31382**	**2173**		**1,402.4**
			Percent of stream with a Moderate Erosion Problem					**23%**										
			Percent of stream with a Severe Erosion Problem					**2%**										
					Total Percent of Stream assessed			100%										

Appendix E. Temperature Collection Sites

Hobo Placement for the Medicine Lodge Drainage

Hobo's programmed to begin collecting data on 6-15-2000 at 10:30 am
Recorded temperature every 2.5 hours
Collected on October 17, 2000

Crooked Creek (2)
#81405, up near the U.S.F.S. boundary
11 N 32 E sec 28, SW of the SW
Lat = 44 degrees 14 minutes 45.17 seconds
Long = 112 degrees 42 minutes 55.0 seconds
Elevation (meters) = 1921.2
Description of placement: At the side road fence just above the second cattlegaurd by Nicholia Canyon.

#81403, lower by the "ranch"
10 N 32 E sec 3, SE
Description of placement: at the fence, at the first gate
DIDN'T WORK

Deep Creek (1)
#81378
11 N 33 E sec 27, NE of the NW
Lat = 44 degrees 15 minutes 32.9 seconds
Long = 112 degrees 34 minutes 7.3 seconds
Elevation (meters) = 1829.7
Description of placement: 100 meters above pond, 10 meters above big rocks in pool

Divide Creek (1)
#81392, higher up on U.S.F.S. land where it won't go dry
13 N 32 E Sec 7, SW of the SW
Lat = 44 degrees 27 minutes 46.0 seconds
Long = 112 degrees 45 minutes 7.5 seconds
Elevation (meters) = 2179.3
Description of placement: 10 m above fence at road crossing, hooked to a rock
REACH WENT DRY DURING SAMPLING PERIOD

Edie Creek (2)
#81387, one at confluence
12 N 33 E sec 17, SW of the NE
Lat = 44 degrees 22 minutes 7.8 seconds
Long = 112 degrees 36 minutes 7.8 seconds
Elevation (meters) = 1889.2
Description of placement: On east side of road, hooked onto a rock at the culvert. The rock is right in front of the culvert with the hobo dangling inside of the culvert.

#74511, at the BLM boundary
12 N 33 E sec 3, SW of the NW
Lat = 44 degrees 23 minutes 52.4 seconds
Long = 112 degrees 34 minutes 25.5 seconds
Elevation (meters) = 2038.2
Description of placement: Up above road crossing where the road forks (one fork goes through creek). Hobo is hooked to an old wooden diversion gate above the 1st cottonwood up river from the road crossing on the west side of the river.

Fritz Creek (2)
#81383, at forks
13 N 32 E sec 32, NE of the NE
Lat = 44 degrees 24 minutes 54.2 seconds
Long = 112 degrees 43 minutes 2.6 seconds
Elevation (meters) = 2107.4
Description of placement: Where the braiding begins, on the left braid 30 meters above the forks (South Fork dry)

#74453, at the confluence
13 N 32 E sec 26, SE of the NW
Lat = 44 degrees 25 minutes 36.9 seconds
Long = 112 degrees 39 minutes 56.6 seconds
Elevation (meters) = 1992.2
Description of placement: 200 meters above mouth at fence

Horse Creek (1)
#74521, at the confluence
13 N 32 E sec 26, NE of the NW
Lat = 44 degrees 25 minutes 43.9 seconds
Long = 112 degrees 40 minutes 13.4 seconds
Elevation (meters) = 1995.8
Description of placement: 40 meters below the Divide Creek road crossing

Indian Creek (2)
#81402, high on west fork
13 N 34 E sec 34, SE of the SE
Lat = 44 degrees 24 minutes 20.8 seconds
Long = 112 degrees 26 minutes 24.9 seconds
Elevation (meters) = 2133.6
Description of placement: Drive along the west fork until you hit the U.S.F.S. boundary. There is a brown sign with an up arrow and a number 205 that marks the F.S. boundary. Just past the cattle guard there is an old wood fence. Follow the fence down to the river. The hobo is hooked to the fence post on the east side of the river and hidden under debris and rocks.

#81388, below forks
We could not get to this area due to private property

Irving Creek (3)
#81399, at the confluence
13 N 32 E sec 36, NW of the SE
Lat = 44 degrees 24 minutes 31.33 seconds
Long = 112 degrees 38 minutes 37.6 seconds
Elevation (meters) = 1965.7
Description of placement: Hobo is hooked onto a rock at the confluence upriver from the culvert about 4 feet, right in the middle of the creek.

#81398, East Fork
13 N 33 E sec 21, NE of the NW
Lat = 44 degrees 26 minutes 41.0 seconds
Long = 112 degrees 35 minutes 7.3 seconds
Elevation (meters) = 2158.6
Description of placement: Drive up road past the cattlegaurd with the BLM sign on it, and follow that fence down to river. Hobo is attached to a cottonwood right upriver from the fence on the roadside of the creek.

#81382, above the forks
13 N 33 E sec 17, SW of the SW
Lat = 44 degrees 26 minutes 48.2 seconds
Long = 112 degrees 36 minutes 43.3 seconds
Elevation (meters) = 2094.9
Description of placement: Go through the Angielen Ranch and over cattlegaurd. Turn right at the BLM boundary. 20 feet above the fence marking the BLM boundary the hobo is hooked onto a root mass on the South side of the river and is tucked under the root mass.

Medicine Lodge Creek (3)
#81391, at Small
10 N 35 E sec 5 SW of the SW
Lat = 44 degrees 13 minutes 2.62 seconds
Long = 112 degrees 22 minutes 30.9 seconds
Elevation (meters) = 1603.2
Description of placement: hobo placed on the south side of the bridge on the main road at Small. Hobo is hooked to the fence post on the SW side of creek.

#81390, at Spring Hollow Creek
12 N 33 E sec 33, NE of the NE
Lat = 44 degrees 19 minutes 40.3 seconds
Long = 112 degrees 34 minutes 45.4 seconds
Elevation (meters) = 1829.1
Description of placement: 14 miles up MLC from Small, the hobo is placed at an abandoned log house with outbuildings with a Teton Regional Land Trust Conservation Easement sign on the

fence. This abandoned house is also about 1 mile downriver from Spring Hollow Creek. If you walk through the gate to the river there is a tree on the North side of the creek. The hobo is hooked to a rock and laid in the river about 1/3 of the way across, parallel to the tree.

#81404, at the bridge above Middle Creek
11 N 34 E sec 22, NE of the NE
Lat = 44 degrees 18 minutes 56.34 seconds
Long = 112 degrees 28 minutes 25.6 seconds
Elevation (meters) = 1809.3
Description of placement: About 40 feet above the Middle Creek culvert there is a lone tree on the roadside of the creek. There is an opening in the grass and rock embankment down to the river where the hobo has been hooked to a rock on the side of the river.

Middle Creek (2)
#81385
12 N 34 E sec 29, SE of the NE
Lat = 44 degrees 20 minutes 25.7 seconds
Long = 112 degrees 28 minutes 40.5 seconds
Elevation (meters) = 1858.4
Description of placement: From Indian creek we took the road over to Middle to the gate. Down river from the gate there is an old wooden walking bridge. The hobo is placed under a cottonwood, which is about 100 feet downstream from the bridge at the first bend in the creek from the bridge. The hobo is on the downstream side of the tree.

#81397, at the confluence
11 N 34 E sec 15, SE of the SE
Lat = 44 degrees 18 minutes 56.57 seconds
Long = 112 degrees 28 minutes 24.6 seconds
Elevation (meters) = 1809.6
Description of placement: Below the culvert on the south side of the MLC road. The hobo is attached to a root on the east side of the culvert.

Warm Creek (1)
#81393, up past the "ranch"
13 N 32 E sec 22, NE of the NW
Lat = 44 degrees 26 minutes 43.4 seconds
Long = 112 degrees 41 minutes 26.5 seconds
Elevation (meters) = 2041.2
Description of placement: Go to the campground above the ranch (campground has fire ring and BLM wire box). Walk upriver and at the third bend in the river above the campground there is a very large boulder. The hobo is hooked onto a rock at the center of the creek close to the boulder and hidden under the long grass inside of creek.

Warm Springs Creek (1)
#81395, up near the springs
11 N 32 E sec 36, NE of the NW

Lat = 44 degrees 14 minutes 38.4 seconds
Long = 112 degrees 38 minutes 50.3 seconds
Elevation (meters) = 1888.8
Description of placement: Upper end of the second campground above the U.S.F.S. boundary

Webber Creek (3)
#81396-0225, past U.S.F.S. at trailhead (2 hobo's placed together for QA)
12 N 32 E sec 15, SW of the SW
Lat = 44 degrees 21 minutes 48.0 seconds
Long = 112 degrees 41 minutes 17.9 seconds
Elevation (meters) = 2108.3
Description of placement: 10 meters above trail sign, dead log on right bank.

#81381, at confluence
12 N 33 E sec 17, SE of the NW
Lat = 44 degrees 22 minutes 12.8 seconds
Long = 112 degrees 36 minutes 18.8 seconds
Elevation (meters) = 1892.5
Description of placement: 80 meters above the mouth, 10 meters below fence on right bank.

Appendix F. Draft Implementation Plan

DRAFT

Medicine Lodge Creek Subbasin Total Maximum Daily Load Implementation Plan for Agriculture

Medicine Lodge Creek Subbasin Total Maximum Daily Load Implementation Plan for Agriculture

Developed for the

Idaho Department of Environmental Quality

Prepared by
Elliot Traher
Water Quality Resource Conservationist
Idaho Association of Soil Conservation Districts
St. Anthony, Idaho
In
Cooperation with Clark Soil and Water Conservation District
April 2002

IASCD
IDAHO ASSOCIATION OF
Soil Conservation Districts

Table of Contents

Tables and Figures

Acronyms:

AFO - Animal Feed Operation.

BMP - Best Management Practice.

BPA - Bonneville Power Administration.

CRP - Conservation Reserve Program.

EPA - Environmental Protection Agency.

EQIP - Environmental Quality Incentives Program.

FSA - Environmental Quality Incentives Program.

HIP - Habitat Improvement Program.

IASCD - Idaho Association of Soil Conservation Districts.

ICA - Idaho Cattle Association.

IDEQ - Idaho Department of Environmental Quality.

ISCC - Idaho Soil Conservation Commission.

ISDA - Idaho State Department of Agriculture.

NRCS - Natural Resources Conservation Service.

MOU - Memorandum of Understanding.

CSWCD - Clark Soil and Water Conservation District.

RCRDP - Resource Conservation and Rangeland Development Program.

RMS - Resource Management System.

SAWQP - State Agricultural Water Quality Program.

TMDL - Total Maximum Daily Load.

TU - Treatment Unit.

UI-CES - University of Idaho, Cooperative Extension System.

USGS - United States Geological Survey.

WQLS - Water Quality Limited Segment.

Introduction

Purpose

The purpose of this plan is to recommend BMPs that would improve or restore physical, chemical, and biological functions for Medicine Lodge, Edie, Fritz, and Irving creeks. This plan will satisfy the requirements described in Idaho Code 39-3601. This plan will build upon past conservation accomplishments that have been made and will assist and/or compliment other subbasin efforts in restoring beneficial uses.

Goals and Objectives

The goal of the agricultural component of the Medicine Lodge Subbasin TMDL Implementation Plan is to restore cold-water biota and salmonid spawning beneficial uses in streams on private agricultural lands. The purpose of this document is to identify the BMPs that will be needed to meet the requirements of the TMDL. The implementation plan identifies BMPs to treat approximately 38 miles of streams within the subbasin. This includes more than 1,650 acres of riparian area that need to be treated.

The objectives of this plan include the following:

?? Improve riparian and stream channel habitat
?? Reduce stream channel erosion
?? Improve grazing management
?? Decrease sediment, nutrient and bacteria concentrations
?? Reduce livestock concentration on streams
?? Eliminate runoff from AFOs
?? Monitor project progress and apply adaptive management

Beneficial Use Status

Medicine Lodge Creek, Edie Creek, Irving Creek, and Fritz Creek are on the State of Idaho's 1998 303(d) list of water quality impaired water bodies. Medicine Lodge Creek (WQLS# 2206) is listed from Spring Hollow to the town of Small, Idaho. Edie Creek (WQLS# 2210) is listed from its headwaters to Medicine Lodge Creek. Irving Creek (WQLS# 2211) is listed from its headwaters to Medicine Lodge Creek and Fritz Creek (WQLS# 2212) is listed from Forks to Medicine Lodge Creek. Approximately 35 miles of creeks are listed. Beneficial uses that exist on these creeks include cold-water biota, salmonid spawning, primary contact recreation, secondary contact recreation, and agricultural water supply. Historic impacts within the subbasin have impaired the beneficial uses of Medicine Lodge Creek and its tributaries. The identified problems in the subbasin according to the IDEQ are shown in Table 1.

Table 1. Beneficial Use Support Status of Water Quality Limited Segments (IDEQ 2002)

Stream	WQLS#	Pollutant	Support Status	Concerns
Edie Creek	2210	**Flow Alteration & Sediment**	**Not full support**	**Improper Grazing & Stream Bank Erosion**
Fritz Creek	2212	Nutrients & Temperature	**Not full support**	**AFOs & Stream Bank Erosion**
Irving Creek	2211	**Habitat Alteration, Nutrients & Sediment**	**Not full support**	**Improper Grazing Management, Stream Bank Erosion**
Medicine	2206	**Flow Alteration, Sediment & Temperature**	**Not full support**	**Stream Bank Erosion, Unstable Diversions, Lack of vegetation, AFOs**

The subbasin's TMDL is scheduled for 2004, however extensive inventories and monitoring have already been completed within the subbasin providing agencies a window of opportunity to develop an early TMDL for the subbasin. A proactive approach is being taken by the CSWCD, CDWAG, IDEQ, ISCC, IASCD, and NRCS to address water quality problems for the subbasin.

Project Setting

The Medicine Lodge Creek Subbasin (USGS Hydrologic Unit Code 17040215) is located in northwestern Clark County and is 15 miles west of Dubois, Idaho. The subbasin consists of six subwatersheds, Edie, Fritz, Irving, Indian, Middle, and Medicine Lodge. The subbasin drains approximately 16,195 acres or 25 square miles. Approximately 72% of the land within the subwatersheds are privately owned. Rangeland is the predominant land use within the subwatersheds at 78% of the acres. Elevations range from 9,000 feet at Fritz Peak to 5,000 feet where Medicine Lodge Creeks disappears into the ground.

The subbasin, shown in Figure 1, is a semi-arid steppe with many miles of ephemeral and intermittent drainages. Streams within the subbasin incorporate flow from natural steady thermal springs, to receiving snowmelt directly from the Beaverhead Mountain Range. The subbasin's principal drainage is Medicine Lodge Creek. The headwaters begin at the confluence of Warm and Fritz creeks and then flows approximately 21 miles in a southeasterly direction slightly past the town of Small. The creek then dissipates from diversions and naturally sinks into the channel bed directly above the aquifer northwest of Cedar Butte (BLM 2001).

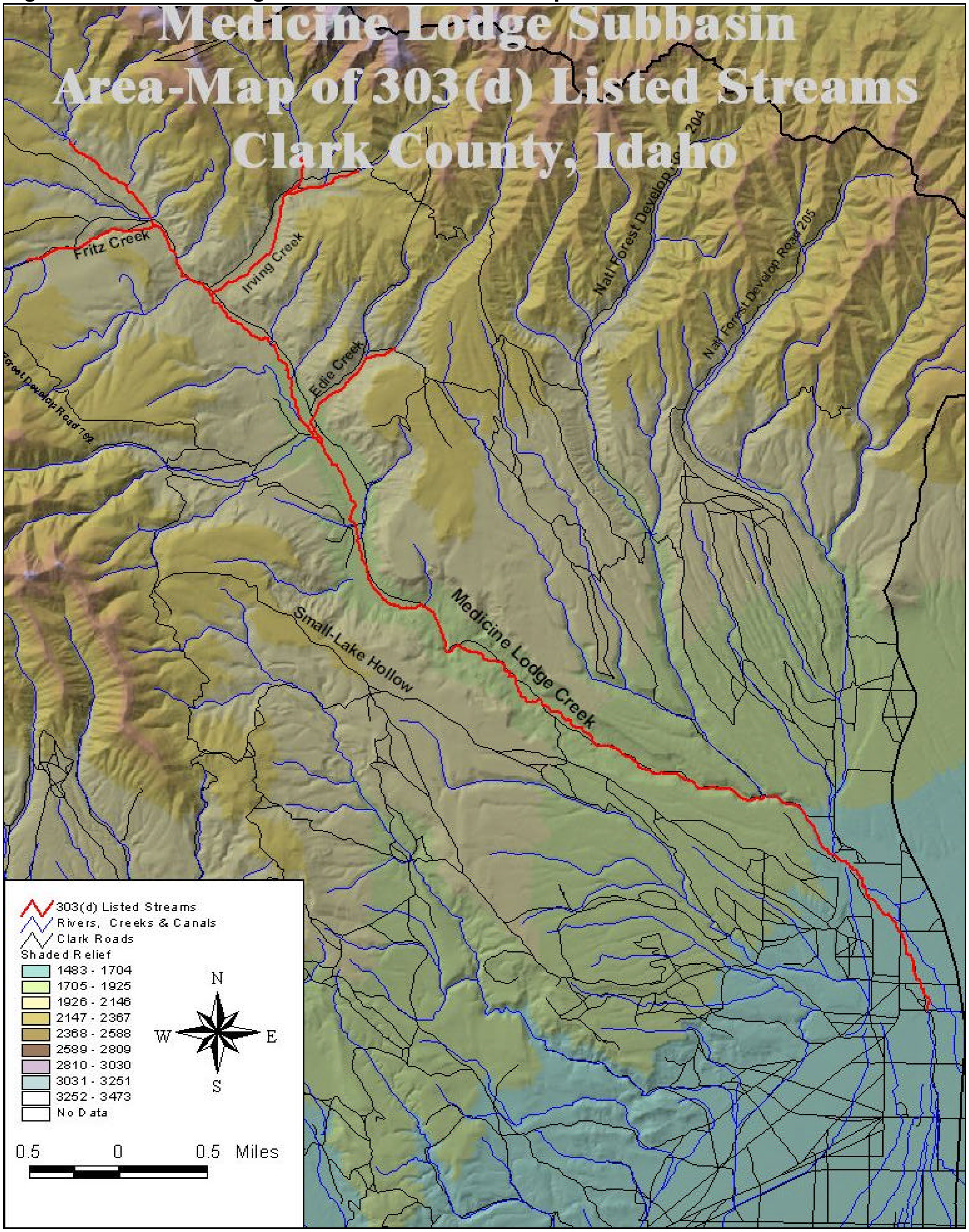
Accomplishments

Several conservation practices have been implemented within the subbasin as shown in Table 2. Most of the projects have focused on agricultural irrigation diversions, irrigation efficiency and prescribed grazing protection. Recently, five additional landowners have applied for assistance to install approximately 485 acres of riparian forest buffer with livestock exclusions through the C-CRP.

Table 2. Completed BMP Projects & Practices in the Medicine Lodge Creek Subbasin.

Target Stream	Acres Treated	Site Type	Work Type	Project Benefits	Program
Medicine Lodge Creek	127	Upland Instream	Irrigation & Grazing Modification	Water Conservation, Riparian Protection, Wildlife Enhancement, Pasture & Hay Land Management	LTA
Medicine Lodge Creek	237	Upland Instream	Irrigation & Grazing Modification	Water Conservation, Wildlife Enhancement, Pasture & Hay Land Management	RCRDP & LTA
Medicine Lodge Creek	2,100	Uplands	Grazing Modification	Wildlife Enhancement, Pasture & Hay Land Management	LTP & LTA
Medicine Lodge Creek	2,041	Uplands	Grazing Modification	Wildlife Enhancement, Pasture & Hay Land Management	LTA
Weber Creek	1,832	Uplands	Grazing Modification	Wildlife Enhancement, Pasture & Hay Land Management	CRMP
Weber Creek	10	Instream	Streambank Stabilization	Bank Erosion Reduction & Irrigation Water Conservation	CRMP
Middle Creek	39	Riparian	Irrigation & Diversion Modification	Water Conservation, Riparian Protection, Wildlife Enhancement & Fish Passage	ACP-ANA
Weber Creek	318	Upland	Grazing Modification	Riparian Protection, Wildlife Enhancement, Pasture & Hay Land Management	CRMP
Medicine Lodge Creek	500	Instream	Fencing & Streambank Stabilization	Riparian Protection, Bank Erosion Reduction	RCRDP

Figure 1. Medicine Lodge Creek Subbasin Area Map



Problem Identification

Pollutants of Concern

The following pollutants were identified on the 1998 § 303(d) list as responsible for, or contributing to, impaired water quality conditions in the Subbasin: nutrients, sediment, flow alteration, habitat alteration, and temperature (IDEQ 2002). Sediment was identified as a pollutant affecting four segments, nutrients affected three segments, temperature affected two segments, habitat alteration affected two segments, and flow alteration affected one segment. All of the identified pollutants in this subbasin originate as nonpoint sources. There are no industrial or municipal point sources of discharge. However seven animal feeding operations have been identified on Medicine Lodge Creek and it tributaries.

There are no state water quality criteria that pertain to flow alteration or habitat alteration, and it is DEQ's policy that TMDLs will not be developed for these pollutants. Among the assumptions used to compile Idaho's 1998 § 303(d) list, DEQ asserts that flow alteration and habitat alteration are 1) not defined by the Clean Water Act as pollutants, and 2) unsuitable for TMDL development (DEQ 1998). The capacity of a waterbody to support aquatic life is initially determined by the presence of water and secondarily by the quality of that water. However, the relationship between flow apportionment and water quality is clearly addressed in Idaho's water quality standards (IDAPA 58.01.02.050.01) as follows;

> The adoption of water quality standards and the enforcement of such standards is not intended to conflict with the apportionment of water to the state through any of the interstate compacts or decrees, or to interfere with the rights of Idaho appropriators, either now or in the future, in the utilization of the water appropriations which have been granted them under the statutory procedure…

Identified Problems

Based on the findings from the ICBEMP, water temperature, sediment, nutrients and stream flow alterations were the most common causes of water quality impairment (Quigley, Arbelbibe, et, al, 1997). Additional findings from BLM address current and historical conditions within the subbasin.

> *"Based on historical accounts and personal communications, many of the tributary streams to Medicine Lodge Creek long ago had extensive beaver dam complexes and ponds that provide abundant fishing opportunities. Today the hydrologic regime is altered with these streams experiencing down cutting and gullying, with a lower water table stressing and reducing remnant riparian wetland vegetation. Beaver removal, dredging, and draining of wetlands, irrigation withdrawals, improper grazing, combined with natural high flow events have all contributed to the present condition. This present condition of the stream channel compared to the earlier prevalence of beaver-dominated systems is still affecting the hydrologic regime and sediment delivery." (BLM 2001)*

Current land use practices, and structures in the subbasin are definitely contributing to the degradation of beneficial uses. The inventories completed by the NRCS and SCC clarifies that removal of vegetation and canopy cover, unstable diversions, and culverts, road encroachment, concentrated livestock feeding and watering areas are underlying factors. IDEQ presumes that beneficial uses were or would be fully supported between current and natural background loading rates. There is no data at this time that can determine what load that may be. Therefore the strategy is to establish a no net trend in load capacities through best management practices improving land use management and restoring beneficial uses. The proposed implementation will focus on four streams in the subbasin, which are on the State of Idaho's 1998 §303(d) list.

Temperature
The temperature load that can be assimilated by any of the stream segments in the subbasin without violating water quality standards or impairing beneficial uses is unknown.

Nutrients
The nutrient load that can be assimilated by any of the stream segments in the subbasin without violating water quality standards or impairing beneficial uses is unknown.

Flow Alteration
There are no state water quality criteria that pertain to flow alteration and it is DEQ's policy that TMDLs will not be developed for these pollutants.

Habitat Alteration
There are no state water quality criteria that pertain to habitat alteration, and it is DEQ's policy that TMDLs will not be developed for these pollutants.

Sediment
The sediment load that can be assimilated by any of the stream segments in the subbasin without violating water quality standards or impairing beneficial uses is unknown. Sediment reductions for individual reaches were assessed and estimated. The following table describes the sediment reductions and reveals segments of concern within the subbasin.

Table 3. Stream Bank Erosion Estimates for Medicine Lodge, Edie, Fritz & Irving Creeks.

Creek	Reach	Inventoried Length (ft)	Percent Inventoried	Existing Erosion (tons/year)	Desired Erosion (tons/year)	Percent Reduction
Edie Creek	E1	5,280	100%	11	11	0
	E2	16,896	100%	347	72	79
	E3	6,336	100%	126	13	90
Fritz Creek	F1	3,168	100%	6	6	0
	F2	6,336	100%	20	20	0
	F3	8,448	100%	19	19	0
	F4	5,280	100%	11	11	0
Irving Creek	I1	24,604	100%	893	118	87
	I2	4,858	100%	72	45	37
	I3	10,560	100%	968	148	85
	EI	9,504	100%	93	64	31
Medicine Lodge Creek	MLC1	17,952	100%	138	76	45
	MLC2	19,008	100%	125	73	42
	MLC3	4,752	100%	157	27	83
	MLC4	12,144	100%	63	63	0
	MLC5	12,000	100%	10	10	0
	MLC6	10,600	100%	367	76	79
	MLC7	17,952	100%	146	100	32
	MLC8	15,734	100%	50	29	42
	MLC9	12,672	100%	516	77	85
	MLC10	1,000	100%	0	0	0

	MLC11	16,896	100%	69	69	0
	MLC12	18,162	100%	92	63	32
	MLC13	10,560	100%	51	42	18
	MLC14	19,008	100%	105	75	29
	MLC15	24,288	100%	215	80	63
	MLC16	16,790	100%	127	91	28
	MLC17	16,896	100%	544	87	84
	MLC18	13,728	100%	175	65	63
	MLC19	6,864	100%	91	29	68
	MLC20	7,392	100%	102	16	85
	MLC21	10,560	100%	19	19	0
	MLC22	15,840	100%	169	35	79
	MLC23	2,112	100%	34	5	84

Stream Assessment Methods

Documenting Field Observations
At each reach, the teams completed field sheets. Photos were taken at the beginning and end of each reach to document conditions during the assessment. Every eroding bank was photographed and measured, inventories were completed on every 303 (d) listed stream in the sub basin, and reference sites were established for future monitoring.

Delineating Stream Reaches
The streams were divided into reaches using soils, geology, slope, sinuosity, vegetation, hydrology, roads, drainage area, valley type and land use. Elevations, slopes, stream order, and sinuosity were determined from 1:24,000 scale DRGs, DLGs and DEMs. The streams in the subwatersheds were compiled from 1:12,000 scale DOQs. Reaches are shown in Figure 2.

Assessing Aquatic Habitat Suitability
SVAP provides a simple procedure to evaluate the condition of a stream based on visual characteristics. The protocol provides an overall assessment of the condition of the stream and riparian ecosystems, identifies opportunities to enhance biological value, and conveys information on how streams function and the importance of protecting or restoring stream and riparian areas (NRCS 1998). SVAP is a qualitative method that includes 14 ranking factors and corresponding numeric values, which are then averaged to rate the reach's condition, as shown in Table 4. Eleven ranking factors are required while three factors are ranked only when applicable. Currently, NRCS requires the use of SVAP when assessing aquatic habitat and recommends that a "fair" condition be achieved as a minimum for conservation plan implementation (NRCS 2001).

Table 4. SVAP Conditions and Average Score Ranges (NRCS 1998)

SVAP Condition	Average Score
Poor	0 to 6.0
Fair	6.1 to 7.4
Good	7.5 to 8.9
Excellent	9.0 to 10.4

Estimating Stream Erosion
SECI estimates long-term stream erosion rates. This method produces an index by ranking six factors; bank stability, bank condition, bank cover, channel shape, channel bottom and deposition. The teams used

SECI to estimate erosion on the entire reach. Eroding sections, not similar to the entire reach's erosion condition, were measured and ranked separately from the rest of the reach. Stream erosion rates are estimated by applying LRRs to bank height and bank length measurements as shown in Table 5. SECI was used for comparison rather than absolute erosion rates in a sediment budget (NRCS 2000).

Table 5. SECI Conditions, Index and LRR Ranges (NRCS 2000)

SECI Condition	Index Range	LRR Range
Slight	0 to 4	0.01 to 0.05 ft/yr
Moderate	5 to 8	0.06 to 0.15 ft/yr
Severe	9 to 12	0.16 to 0.30 ft/yr
Very Severe	12 to 15	0.30 to 0.50 ft/yr

Stream Assessment Results

Summarizing the Assessment Results

CSWCD and NRCS requested permission to conduct the stream assessment. The private landowners granted the team access to all 303(d) listed streams within the subbasin. NRCS, ISCC, and IASCD began the assessment on June 5th, 2000 and finished on August 15th, 2000. The interdisciplinary team assessed approximately 38 miles of streams within the subbasin. Results for each reach are shown in Table 6. About 29 miles of Medicine Lodge Creek, 2.6 miles of Edie Creek, 2.2 miles of Fritz Creek and 4.8 miles of Irving Creek were assessed. The combined SVAP and SECI scores of the assessed reaches are shown in Figure 2. The different protocols allowed the reaches to be evaluated based upon habitat suitability and erosion condition.

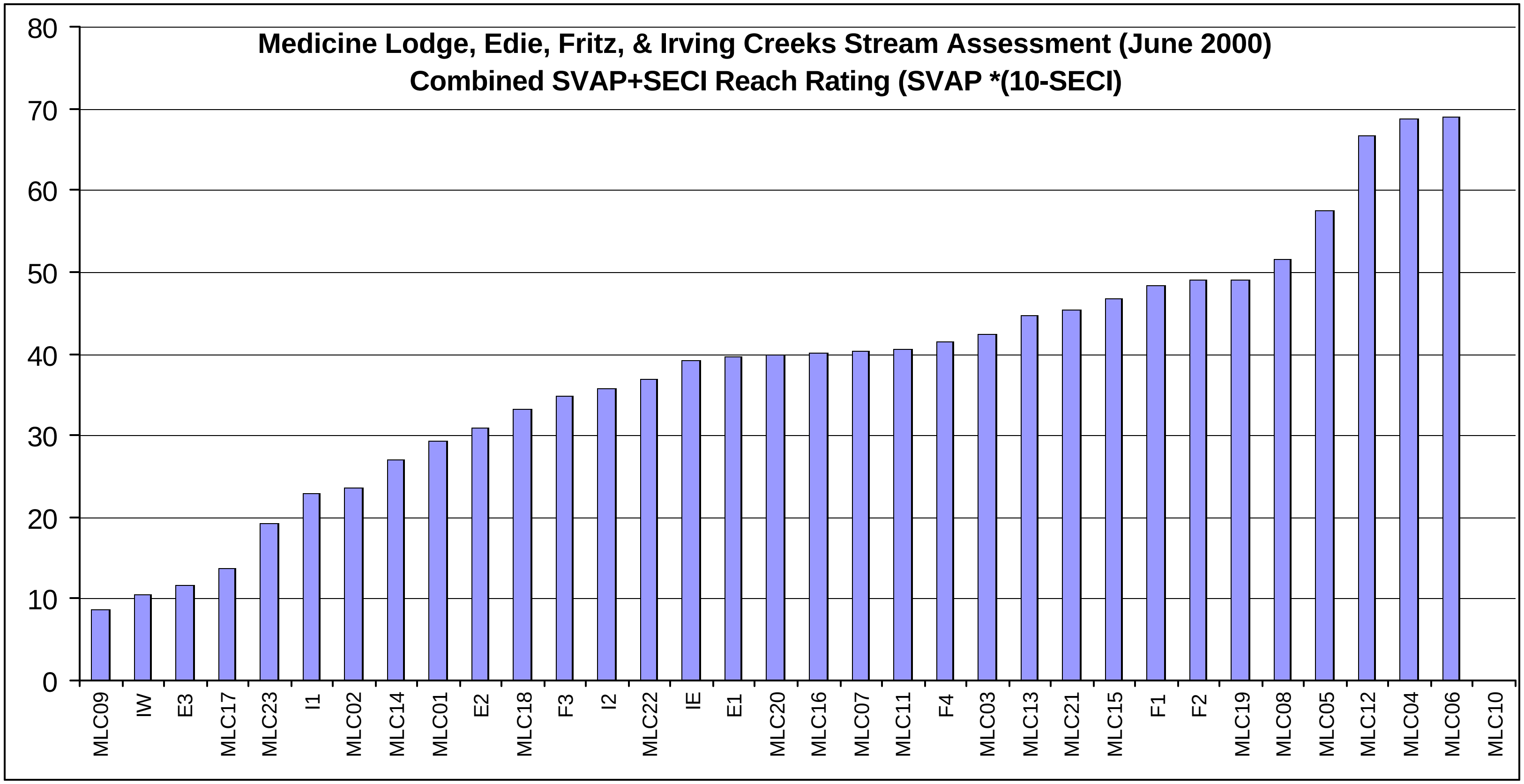
Table 6. Medicine Lodge, Edie, Fritz and Irving Creeks Assessment Summary

Reach	Length	SVAP	SECI Category	Erosion Rate*	Erosion Rate*
MLC1	1.8	Poor	Moderate	100	55
MLC2	1.8	Fair	Moderate	81	44
MLC3	0.5	Poor	Severe	157	342
MLC4	1.2	Fair	Slight	63	57
MLC5	0.7	Fair	Slight	10	15
MLC6	1.3	Fair	Moderate	89	67
MLC7	1.7	Fair	Severe	146	84
MLC8	1.5	Good	Moderate	33	22
MLC9	1.2	Poor	Severe	269	203
MLC10	0.2				
MLC11	1.6	Good	Severe	103	64
MLC12	1.7	Good	Moderate	62	37
MLC13	1.0	Fair	Severe	72	71
MLC14	1.8	Fair	Severe	217	122
MLC15	2.3	Good	Severe	93	40
MLC16	1.6	Fair	Severe	117	74
MLC17	1.6	Poor	Severe	302	190
MLC18	1.3	Fair	Severe	124	94
MLC19	0.7	Fair	Moderate	28	43
MLC20	0.7	Good	Moderate	18	27
MLC21	1.0	Fair	Slight	17	16

MLC22	1.5	Fair	Moderate	41	27
MLC23	0.2	Poor	Moderate	12	55
E1	0.5	Fair	Slight	10.8	23
E2	1.6	Fair	Moderate	84	54
E3	0.6	Fair	Moderate	57	92.7
F1	0.3	Fair	Slight	6	18
F2	0.6	Fair	Slight	20	37
F3	0.8	Poor	Slight	19	23
F4	0.5	Fair	Slight	11	21
I1	2.3	Poor	Moderate	370	158
I2	0.5	Good	Severe	72	154
IW	1.0	Poor	Severe	522	509
IE	0.9	Fair	Severe	94	98
Total	**38 miles**			**3,419 tons/yr**	**2,937 tons/mile/yr**

Erosion Rate = (Stream Length) * Bulky Density * Lateral Recession R

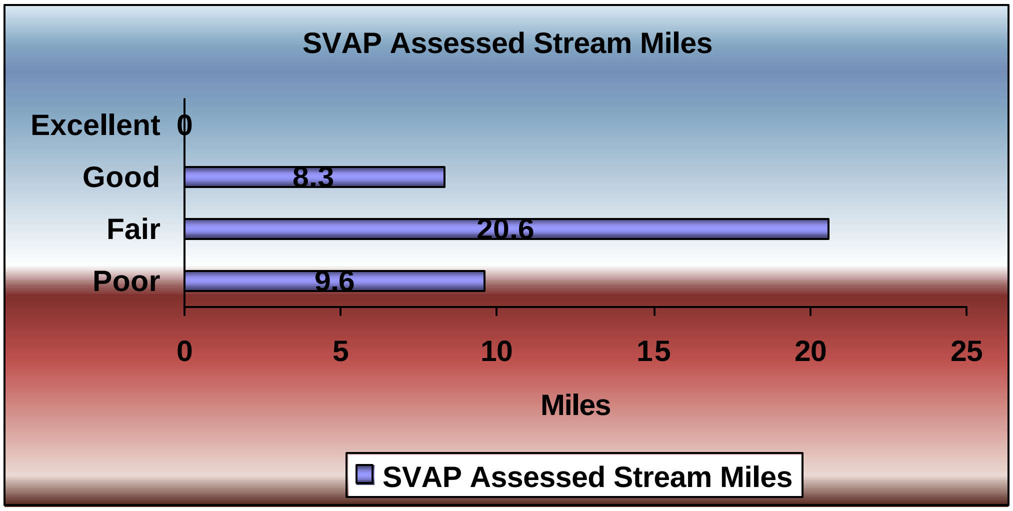
Figure 2. Medicine Lodge, Edie, Fritz and Irving Creeks SVAP/SECI Combined Chart



SVAP Results

SVAP results show that 25% or 9.6 miles of the assessed reaches were in poor condition, 53% or 20.6 miles of the assessed reaches rated in fair condition, while 22% or 8.3 miles of the assessed reaches rated in good condition and 0% rated in excellent condition. These results are Figure 4.

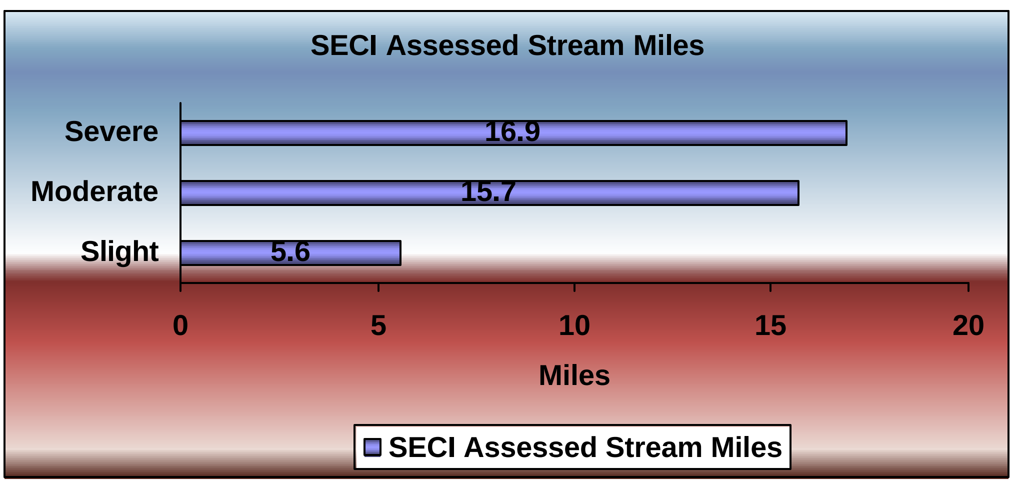
Figure 3. Percent of Assessed Stream Miles for SVAP Rating Categories



SECI Results

SECI results reveal that of the 38 miles of assessed stream miles about 15% or 5.6 miles had slight erosion. While 41% or 15.7 miles rated in moderate erosion condition and 44% or 16.9 miles rated in the severe erosion category. These results are shown in Figure 5.

Figure 4. Percent of Assessed Stream Miles for SECI Categories



Critical Areas

Areas of agricultural lands that contribute excessive pollutants to water bodies are defined as “Critical Areas” for BMP implementation. Critical areas are prioritized for treatment based on their location to a water body of concern and the potential for pollutant transport and delivery to the receiving water body. Agricultural critical areas in all of the listed stream segments within the subbasin are:

✍✍Unstable and erosive streambed or banks

- Unstable irrigation diversion structures
- Areas of channelization or vegetation removal
- Animal Feed Operations

Tiers

There were two tiers delineated within the subbasin. These tiers were determined by the proximity of the critical areas to the §303(d) listed stream segments. Critical areas and tier amounts are shown in Table 7.

Tier 1 Unstable and erosive streambanks and riparian areas or facilities adjacent to the stream that have a direct and substantial influence on the stream.

Tier 2 Pasture and rangelands or AFOs with an indirect, yet significant influence on the stream.

Table 7. Critical Areas by Subwatershed within the Medicine Lodge Subbasin

	TMDL Implementation Tier 1		TMDL Implementation Tier 2	
Subwatershed	**Riparian**	**AFO**	**Pasture Land**	**Range Land**
Eddie Creek	118		17	1,000
Fritz Creek	96	2	0	428
Irving Creek	204		350	1,129
Medicine Lodge Creek	1,252	5	4,065	6,946
Totals	1,670		5,864	9,503

Animal Feed Operations

National Definition: The term "animal feeding operation" or AFO is defined in EPA regulations as a "lot or facility" where animals "have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period and crops, vegetation, forage growth, or post-harvest residues are not sustained in the normal growing season over any portion of the lot or facility."

The Idaho Legislature passed the Beef Cattle Environmental Control Act in the spring of 2000. Governor Kempthorne then signed this Act in April 2000. ISDA then went into a rule making process and on September 18, 2000, the "Rules of the Department of Agriculture Governing Beef Cattle Animal Feeding Operations" (IDAPA 02.04.15) became effective. Subsequent to the rules becoming effective, a Memorandum of Understanding (MOU) was written and signed by ISDA, IDEQ, ICA, and EPA in January 2001. The MOU gave ISDA authority to regulate beef cattle feeding operations that fall under the definitions of IDAPA 02.04.15 not located on Indian Reservations (ISDA 2000).

Threatened and Endangered Species

According to the Medicine Lodge Subbasin Assessment written by IDEQ, there are three species of salmonids in the Medicine Lodge Drainage. These include Yellowstone cutthroat (*Oncorhynchus clarki*), Brook trout (*Salvelinus fontinalis*) and Rainbow trout (*Oncorhynchus mykiss*). The Yellowstone Cutthroat is considered a state sensitive species in Idaho and is carefully managed by the IDFG. In 1998, it was petitioned to become a threatened species, but after review in February 2001, the USFWS declined the petition to list the Yellowstone Cutthroat under the Endangered Species Act. Medicine Lodge Creek also contains non-salmonid species of fish, including the Short-headed Sculpin (*Cottus confusus*), which are found in the majority of the tributaries as well as the main stem of Medicine Lodge Creek. Western Mosquito fish (*Gambusia affinis*), a warm water species, have also been found in Warm Springs Creek and have obviously been introduced although there are no records of this (NRCS 2002 Tech Guide).

According to the USFWS, there are two threatened species in Clark County, the Grizzly bear (*Ursus arctos horribilis*) and the Bald eagle (*Haliaeetus leucocephalus*). The Gray wolf (Canis lupus) is the only species listed as endangered in Clark County. The Gray wolf is considered experimental/non-essential under section 10(j) of the Endangered Species Act. Under these circumstances, Federal action agencies are required to confer with the USFWS if their actions are likely to jeopardize the continued existence of Gray wolves as well as any other species listed as threatened or endangered (NRCS 2002 Tech Guide).

Proposed Treatment

Treatment Units

The TUs describe areas with similar use, productivity, resource concern and treatment needs. These not only provide a method for delineating and describing land use but are also used to evaluate land use impacts to water quality and in the formulation of alternatives for solving identified problems. TUs are geographically shown in Figure 5.

Treatment Unit #1 Middle Main Stem

Acres	Soils	Description	Resource Problems
122	Soils consist of very deep, well-drained soils formed in alluvium with some loess and silty alluvium. Slopes are from 0-45% to 0-60%, permeability is moderate, with particle size ranging from silt to sand with some gravel and cobble	Straightened or manipulated channels, moderately entrenched, collapsing meanders, flat gradient, with minimal canopy cover.	Sediment from bank erosion Head cutting from failing culverts Bank trampling from livestock Unstable irrigation diversions Temperature from lack of canopy cover, Meadow dewatering from down cutting Nutrients from the livestock.

Treatment Unit #2 Lower Tributaries

Acres	Soils	Description	Resource Problems
275	Soils consist of very deep, somewhat poorly drained soils that formed in recent alluvium from welded tuff and basalt to well drained soils on mountains that formed in local alluvium or colluvium derived from limestone and loess. Permeability is from slow to moderate, slope are from 0-4% to 4-70% and the typical pedon ranges from a silt loam to a very gravelly loam.	Somewhat wide streams of low gradient (1%). Depositional areas, with high width to depth ratio. Poorly constructed irrigation diversions	Sediment from streambank erosion, livestock concentration, and failing beaver dams. Temperature increase from lack of canopy cover, downing cutting and meadow dewatering. Possible nutrient contribution from animal impact.

Treatment Unit #3 Tributaries

Acres	Soils	Description	Resource Problems
211	Soils mostly consist of very deep, well drained soil that form in alluvium from calcareous siltstone, mudstone, sandstone, quartzite, basalt and tuff. They have slopes of 4 to 7%. Soils vary from gravelly silty loams to very gravelly loams with slow to moderate permeability.	Wide streams of high gradient (2-3%). Moderately entrenched with cut banks. Fine sediment deposition and high grazing use.	Sediment from streambank erosion, livestock concentration, and failing beaver dams. Temperature increase from lack of canopy cover, downing cutting, meadow dewatering and natural warm springs. Possible nutrient contribution from animal impact.

Treatment Unit #4 Lower Main Stem

Units	Soils	Description	Resource Problems
172	Soils are very deep, well drained	Moderately	Sediment from streambank

	formed in alluvium with some loess and silty alluvium from loess influence on fan terraces, foothills and mountain slopes. Slopes are 0-60%, moderate permeability, with a typical pedon consisting of a gravelly silt loam	entrenched, with flat gradients, minimal canopy cover, diversions, feedlots and animal crossing	erosion, poor/failing culverts, and failing diversion. Increase in temperature from lack of canopy cover, widening streams and meadow dewatering.

Treatment Unit #5 Upper Main Stem

Acres	Soils	Description	Resource Problems
330	Soils are very deep, well-drained formed in slope alluvium derived from calcareous siltstone, shale and some limestone. Slopes are 0-70%, moderate permeability, with a typical pedon consisting of a loam	Widening streams of low gradient (1%). Low cut banks, woody vegetation, fine sediment, and lack of pasture.	Sediment from concentrated livestock and upland area. Increase in temperature from lack of canopy cover and nutrients from concentrated grazing animals.

Treatment Unit #6 Upper Tributaries

Acres	Soils	Description	Resource Problems
200	Soils consist of very deep, well drained soils that formed in recent alluvium from welded tuff and basalt to well drained soils on mountains that formed in local alluvium or colluvium derived from limestone and loess. Permeability is from slow to moderate, slopes are from 0-4% and 4-70% and ranges from a silt loam to a very gravelly loam.	Narrow streams of low gradient. Very little in-channel sediment, with low width to depth ratio	Overgrazing resulting in decreased vegetative condition, suitability, and composition. Unstable and eroding streambanks. Sediment from failing beaver dams and poor constructed culverts. Increased water temperature. Increased bacterial contribution to the stream.

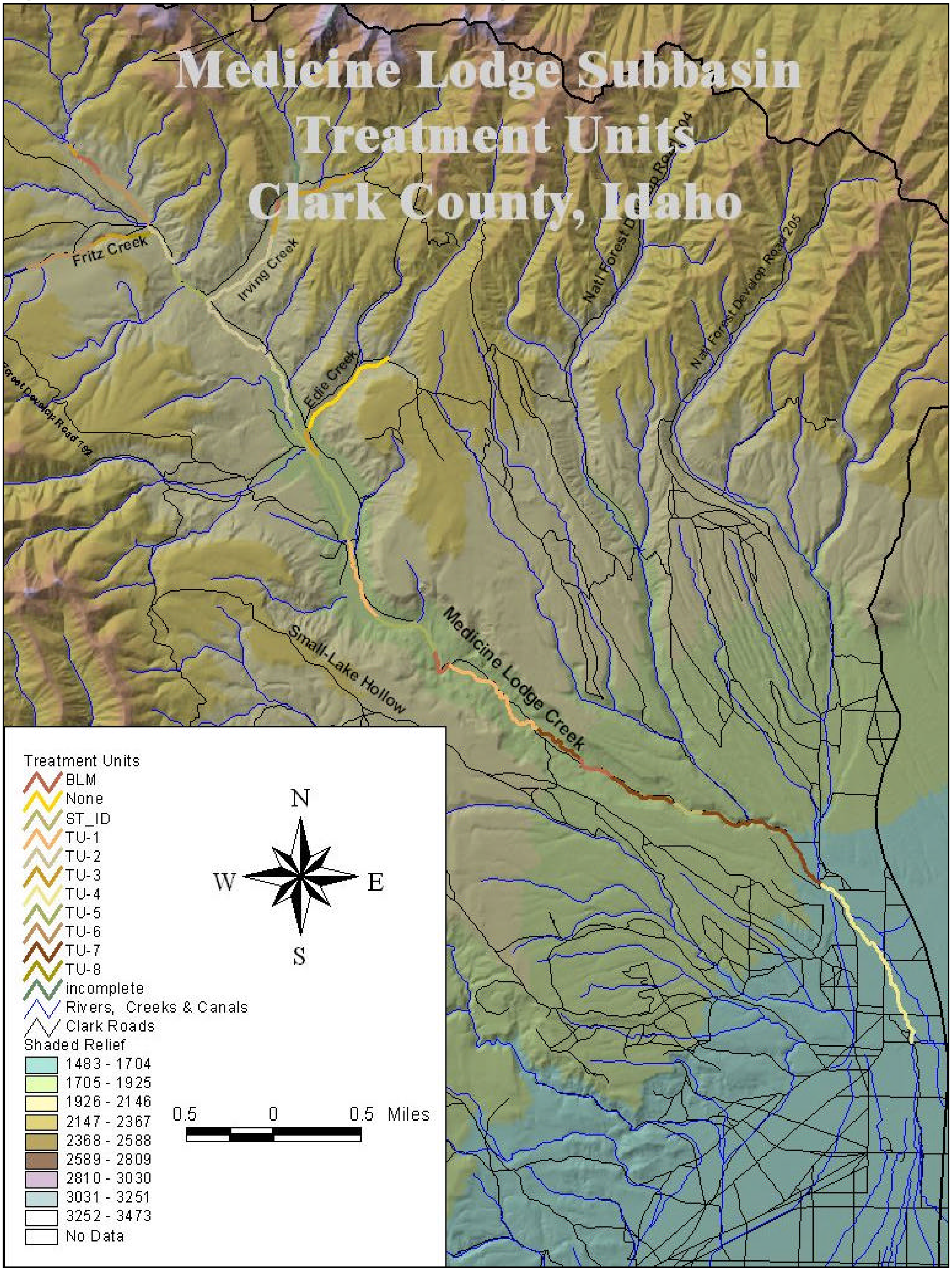
Treatment Unit #7 Main Stem

Acres	Soils	Description	Resource Problems
282	Soils are very deep, well-drained formed in slope alluvium and in calcareous loess derived from calcareous siltstone, shale, and rhyolite. Slopes are 1-70%, moderate permeability, with pedons ranging from a loam to a gravelly silt loam.	Narrow valley, straight, high canopy cover, some road encroachment, and few ox-bow cutoffs.	Sediment from road, nutrients from recreation.

Treatment Unit #8 Lower Fritz Creek

Units	Soils	Description	Resource Problems
13	Soils range from well drained and moderately deep to very deep and poorly drained. Formed from recent alluvium from mixed sources, permeability ranges from moderate to slow, slopes range from 0-12% and the typical pedon would be a silt loam.	Moderately entrenched, flat gradient, coarse soils, with no canopy cover, high width to depth ratio and large macrophyte beds.	Temperature from lack of canopy cover, from stream widening and from warm springs. Nutrients from grazing animals and possible septic.

Figure 5. Medicine Lodge, Edie, Fritz and Irving Creeks Treatment Units



BMP Implementation

The proposed treatment for sediment, nutrient and temperature reduction will be to implement BMPs through RMS conservation plans in TUs within each subwatershed. RMS plans are a combination of BMPs and is defined in Idaho's Agricultural Pollution Abatement Plan. Table 8 lists the estimated cost of BMPs.

Table 8. Total BMP Costs for the entire Medicine Lodge Subbasin (all treatment units)

Treatment Units 1-8: Middle Main Stem, Lower Tributaries, Tributaries, Lower Main Stem, Upper Main Stem, Upper Tributaries, Main Stem, Lower							
Components	**Unit Type**	**Unit Cost**	**C/S Percent**	**Unit Amount**	**C/S Funds**	**Operator Funds**	**Total Funds**
Prescribed Grazing - 528							
Prescribed Grazing System	Ac	$22.49	75%	1,134	$19,129	$6,376	$25,506
Riparian Exclusion	Ac	$74.87	75%	290	$16,284	$5,428	$21,713
Riparian Forest Buffer - 319							
Trees shrubs, Bareroot	Ft	$4.81	75%	94,409	$340,301	$113,434	$453,735
Trees Shrubs, Containerized	Ft	$2.39	75%	97,609	$175,294	$58,431	$233,726
Fence 4-Wire	Ft	$1.5	75%	204,271	$229,805	$76,601	$306,406
Streambank Protection - 580							
Vegetation Revetments	Ft	$44.52	75%	8,837	$29,508	$9,836	$39,345
Poles or Bundles	Ft	$3.00	75%	49,228	$20,763	$6,921	$27,684
Clump Planting	Ft	$10.00	75%	2,424	$18,180	$6,060	$24,240
Barbs	Each	$1,000	75%	49	$36,750	$12,250	$49,000
Toe Rock	Ft	$29.60	75%	4,200	$93,240	$31,080	$124,320
Stream channel Stabilization - 584							
Rock V-weir	Each	$1,568	75%	44	$51,750	$17,250	$69,000
Structures for Water Control							
Diversions	Each	$3,654	75%	13	$35,625	$11,875	$47,500
Diversions (concrete, pipe, fish screens)	Each	$21,250	75%	4	$63,750	$21,250	$85,000
Rock V-weirs	Ft	$1,000	75%	6	$4,500	$1,500	$6,000
Animal Trails and Walkways - 575							
Crossing	Each	$1,800	75%	5	$6,750	$2,250	$9,000
Water Facilities - 614							
Water Gaps	Each	$2,500	75%	57	$106,875	$35,625	$142,500
Water Developments	Each	$5,000	75%	10	$37,500	$12,500	$50,000
Waste Storage Facilities - 313							
Corral Dikes	Ft	$4.5	75%	1,500	$5,062	$1,687	$6,750
Corral Systems	Each	$8000	75%	4	$24,000	$8,000	$32,000
				Totals	$1,315,069	$438,356	$1,753,425

Funding

Current funding for implementation of agricultural projects is being provided through WQPA, §319, C-CRP programs. Other potential funding sources being evaluated include EQIP, RCRDP, and BPA.

Information and Outreach

The conservation partnership (CSWCD, ISCC and USDA-NRCS) will use their combined resources to provide information to agricultural landowners and operators within the subbasin. A local outreach plan will be developed by the conservation partnership. Newspaper articles, district newsletters, watershed and project tours, landowner meetings, and one on one personal contact will be used as outreach tools. Outreach efforts will:

- Provide information about the TMDL process.
- Provide water quality monitoring results.
- Accelerate the development of conservation plans and program participation.
- Provide progress reports.
- Enhance technology transfer related to BMP implementation.
- Increase awareness of agriculture's contribution to conserve and enhance natural resources.
- Increase the public's awareness of agriculture's commitment to meeting the TMDL challenge.

Evaluation an Monitoring

Evaluation and monitoring will be an integral component of this implementation plan. At the field level the ISCC and USDA-NRCS will complete annual status reviews in cost-share programs such as EQIP, CRP, WQPA, RCRDP, and §319. In addition, the ISCC will complete BMP effectiveness evaluations through out the implementation phase. The ISCC has an established BMP evaluation format and process that will be implemented in conjunction with the annual status reviews. Evaluation protocols have been developed for many water quality BMPs and component practices. Should the situation arise where an appropriate protocol is lacking, the ISCC will work with agencies such as USDA-NRCS, UI-CES, IDEQ, and CSWCD to develop the needed protocol.

At the subbasin level, ISDA and IASCD water quality analysts will provide water quality monitoring. The CSWCD plans to coordinate with IASCD and ISDA in developing a water quality BMP effectiveness-monitoring plan for the entire subbasin. Currently, monitoring is being conducted by the IDEQ. Efforts to develop a monitoring plan have already begun. It is anticipated the plan will be finalized by June 1, 2002 with actual monitoring soon after.

Table 9. Action items to be completed in the Medicine Lodge Subbasin

Priority Subwatershed	Action Item	Completion Date
1. Medicine Lodge Creek	Outreach efforts for example projects, tours and newsletters	
	Complete conservation plans with project contracts	
2. Irving Creek	Outreach efforts for example projects, tours and newsletters	
	Complete conservation plans with project contracts	
	Ongoing surveys and inventories for the west fork	
3. Fritz Creek	Outreach efforts for example projects, tours and newsletters	
	Complete conservation plans with project contracts	
4. Edie Creek	Complete conservation plans with project contracts	
	Outreach efforts for example projects, tours and newsletters	

References

IDEQ. Idaho Department of Environmental Quality, 2002. Medicine Lodge Subbasin TMDL: An allocation of nonpoint source pollutants in the water quality limited watersheds of the Medicine Lodge Subbasin. 19 pp. Idaho Falls, Idaho.

IDEQ. Idaho Department of Environmental Quality, 1999. Lemhi River Watershed TMDL: An allocation of nonpoint source pollutants in the water quality limited watersheds of the Lemhi River valley. 54 pp. Idaho Falls, Idaho.

IBLM. Idaho Bureau of Land Management. 2001. Medicine Lodge Subbasin Review. 8-10 pp. Idaho Falls, Idaho.

ISDA. Idaho State Department of Agriculture. 2001. The Idaho Beef Cattle Environmental Control Memorandum of Understanding. 7 pp. Boise, Idaho.

ISDA. Idaho State Department of Agriculture. 2000. Beef Cattle Animal Feeding Operation Program. 3 pp. Boise, Idaho.

NRCS. Natural Resources Conservation Service. 1983. Erosion and sediment yield. In: Proceedings from the Channel Evaluation Workshop. Ventura, CA.

Lehman, Bob. 2001. Personal communication. Engineer, USDA-NRCS. Rexburg Idaho, Idaho.

Kotansky, Dan. 2001. Personal communication. Hydrologist, BLM. Idaho Falls, Idaho.

Appendix G. Public Comments

Public comment for the Medicine Lodge Subbasin Assessment and TMDL began August 7, 2002 and ended September 6, 2002. A request for comments appeared in the the Idaho Falls Post Register on August 7, 2002. There were several meetings prior to the comment period with the Medicne Lodge Watershed Advisory Group. The most recent meeting was held September 2, 2002, just prior to the end of the public comment period.

In addition, the Medicine Lodge Subbasin Assessment and TMDL was distributed to EPA, BLM, USFS, Idaho Fish and Game, and the NRCS for review. Comments were received from EPA Region 10 and the Forest Service, Caribou-Targee National Forest, Dubois Ranger District.

Comments from Jayne Carlin, EPA Region 10, Watershed Restoration Unit

Sediment Loading Analysis

1. **Comment:** IDEQ linked stream bank erosion to stream bank stability. Stream bank stability was used as a surrogate for the sediment TMDL, with the target of 80% stream bank stability. Then, IDEQ developed quantitative load allocations and reductions based on the data obtained from stream bank erosion surveys. Although IDEQ provided the stream bank assessment summaries, the IDEQ failed to describe the protocol used in obtaining this data or provide the actual data.
   Recommendation: The TMDL document would be improved if IDEQ included the stream bank erosion methods and results (Stream Bank Erosion Inventory Worksheets) as an appendix to the TMDL.

   Response: *DEQ has added Appendix E to the Medicine Lodge Creek TMDL which contains streambank erosion inventory monitoring methods and results used in the development of this TMDL.*

Margin of Safety

2. **Comment:** IDEQ stated that the temperature TMDL has an implicit Margin of Safety (MOS) in that the MOS is inherent in the state's water quality standards (WQS) for temperature. The MOS is intended to account for uncertainty in the TMDL and the calculations within the TMDL to ensure that allocations will lead to the attainment of the WQS. Therefore, any conservatism which may be within the WQS cannot be counted as a margin of safety to attain the WQS.
   Recommendation: Include an explanation for the margin of safety which meets the intent and purpose of the MOS.

   Response: *The explanation of MOS has been modified to reflect that the MOS was factored into the the temperature TMDLs by basing the TMDLs on the maximum temperatures exceedances observed in each stream. If the maximum exceedances are* *eliminated, it is likely that other exceedances observed during the critical time periods will be eliminated also.*

3. **Comment:** IDEQ states that the sediment TMDL's margin of safety (MOS) is implicit based on conservative assumptions used to develop existing sediment loads: 1) that the desired bank erosion rates are representative of background conditions and 2) that water quality targets for percent depth fines are consistent with values measured and set by local land management agencies based on established literature values and incorporate an adequate level of fry survival to provide for stable salmonid production. IDEQ failed to explain how the background conditions would be considered conservative. IDEQ also failed to explain whether the values based on established literature values are being set at a level which is more stringent than what would be adequate to meet the beneficial use of salmonid spawning. Was a more protective literature value chosen that would exceed an adequate level of fry survival?
   Recommendation: Include an explanation on how each of the assumptions would be considered conservative.

   Response: *DEQ provided further explanation of why the assumptions factored into the MOS for sediment TMDL load allocations are considered conservative on page 85 of this TMDL. It is expected that the beneficial uses for the sediment listed streams will be attained prior to meeting the TMDL targets in this TMDL, since the TMDL targets are based on meeting background conditions. Therefore, sediment TMDLs developed for the Medicine Lodge Subbasin are considered conservative.*

Seasonal Variations

4. **Comment:** The Clean Water Act and implementing regulations require that a TMDL be established with consideration of seasonal variations. IDEQ states, A seasonal variations in sediment loading are not considered" which implies that IDEQ did not develop the sediment TMDL with consideration of seasonal variations. Yet, the information following the above statement explains how seasonal variations were considered in the TMDL analysis.
   Recommendation: Begin seasonal variations section with a statement that IDEQ considered seasonal variations when developing the sediment TMDL and then explain how seasonal variations were considered.

   Response: *The seasonal variation for sediment was considered in this TMDL and an explanation of how seasonal variation was considered is provided on page 85. Seasonal Variation was included through streambank erosion inventory monitoring, which considers that the greatest amount of streambank recession occurs when streams are at peak flows. Peak flows for this watershed occur in the early summer months.*

5. **Comment:** In the section on seasonal variation, IDEQ does not discuss the temperature TMDLs. Therefore, it is implied that IDEQ did not consider seasonal variations when developing the temperature TMDL.

Recommendation: Include an explanation under seasonal variation on how IDEQ considered seasonal variations when developing the temperature TMDL. It appears that IDEQ incorporated seasonal variations by taking into account the critical seasons for critical life stages of fish species present and evaluating temperature at the hottest time of the year (summer) and setting TMDL in accordance with reductions needed during period where there is greatest variation between current in-stream temperature and criteria.

Response: *DEQ modified the temperature seasonal variation explanation on page 85 to describe that TMDL reductions were developed from temperature exceedances observed during the spring and summer seasons where there is the greatest exceedances and there is greatest variation between current in-stream temperature and the temperature criteria.*

6. **Comment:** Note that there are numerous typographical errors in the Executive Summary which IDEQ may want to correct before finalizing the TMDL.

   Response: *DEQ corrected typographical errors in the executive summary of this TMDL.*

Comments from Robbert Mickelsen and Mike Philbin, Caribou-Targee National Forest, Dubois Ranger District.

1. **Comment:** Page 61, the first paragraph under the status of beneficial uses says that "the majority of sites located in streams listed for sediment exceed the sediment target". However, the target is just that – a target. If beneficial uses are fully supported, even at levels above the target, than the stream should not be listed.

   The second paragraph says that the salmonid spawning temperature standard has been exceeded, but a closer review of the data (table 10) shows that most exceedances actually occurred outside the critical time periods identified on page 71. Therefore, these streams do not exceed the salmonid spawning standard (especially the reference Webber Creek).

   Response: *BURP data was not assessed for the Medicine Lodge Subbasin because this report was written between implementation of Waterbody Assessment Guidance (WBAG) 1 and WBAG2 assessment methodologies. Based on this comment, DEQ recently evaluated data collected on the streams of concern using the WBAG2 methods and verified that the streams listed did not support beneficial uses. In addition, other sediment data on the streams of concern were collected which include Depth Fines data, Surface Fines Data, Streambank Erosion Inventories, Stream Visual Assessment Protocol, and Proper Functioning Condition. The collected data supported DEQ's determination that beneficial uses are not supported for the streams of concern, hence, sediment TMDL's for Irving Creek, Edie Creek, and Medicine Lodge Creek were developed.*

   In response to the second part of this comment, Table 10 documents exceedences in temperature criteria for the spring, summer, and fall season. However, only exceedances observed during the salmonid spawning critical time periods were evaluated in Section 5 of the TMDL. The temperature targets chosen for streams within the Medicine Lodge

Subbasin are summarized on page 77 of the TMDL. These targets are what the TMDLs are based on. DEQ added a reference on page 42 to refer to Section 5 of the TMDL where salmonid spawning time periods for the subbasin were further evaluated.

2. **Comment:** The land management and regulatory agencies consider Webber Creek as the reference stream for this subbasin. As such, it doesn't make sense to list it as impaired. If fact, other streams in this subbasin should be compared to Webber Creek when assessing water quality variables. If Warm Springs Creek were delisted (for temperature) for being at its site potential, why would Webber Creek be listed for being at its site potential?

   Response: *Temperature data collected in Webber Creek exceeded temperature criteria for salmonid spawning, therefore, Webber Creek is considered not full support. In response to this comment, DEQ added that critical time periods for salmonid spawning shall be further evaluated during the implementation phase of this TMDL in Section 2.4 of the Subbasin Assessment.*

3. **Comment:** An earlier review of the temperature data raised questions regarding large diurnal fluctuation on Divide Creek. The other sites had fluctuations of about ten (10) degrees; while in Divide Creek, they were up to 20 degrees. These very large fluctuations, plus the very high temperatures (Table 25), and the extended period of exceedences (Table 25) suggest that this thermograph came out of the water. If so, listing it for exceeding the Cold Water Aquatic Life temperature standard would be incorrect. We recommend collecting additional data before taking this step.

   Response: *DEQ reevaluated the temperature data collected for Divide Creek based on this comment. Based on review of the collected data and further information that the reach was dry during the time of sampling, the TMDL for Divide Creek was removed. It is recommended that this stream be monitored for temperature when wet to determine the status of beneficial uses in Section 2.4 of the Subbasin Assessment.*

4. **Comment:** The influences of upland erosion are difficult to determine. As noted on page 69, the TMDL is supposed to provide a quantification of current pollutant loads by source. However, the document does not do this. While it raises the possibility of upland erosion by discussing soils, erosion rate, summer thunderstorms, and even improved management practices (in section 4 and the implementation plan); it never tells us how much sediment if from upland sources either in absolute terms or relatively. What are the current upland loads? Why isn't there a measure to evaluate reductions from this source – much like bank stability does for in-channel sources? While we agree upland treatments and a watershed approach are important, and feel upland treatments would benefit this watershed, a case for them has not been made in the TMDL. Therefore, we feel that strengthening the tie between upland erosion, sediment production, and treatments would greatly strengthen the document and provide better justification for the proposed implementation plan treatments.

Response: *DEQ used gross allocations of loadings since all loading sources are non-point sources in this subbasin. Information to further break down non-point source loads were not available at the time this TMDL was developed and is not required. In section 3.2 of the Subbasin Assessment, DEQ recognizes that a more detailed breakdown of pollutant sources would be of benefit and warrants further evaluation in the implementation plan.*

5. **Comment:** By not including upland or watershed sources, is there really a margin of safety? It's possible that areas receiving sediment from upland sources could meet bank stability goals, yet not meet sediment target.

   Response: *Upland sources are included in the Margin of Safety. The 80% streambank erosion inventory target combined with the 28% or less fine sediment target factors in loading sources from streambanks and other sources. The premise is that, if streambank erosion inventory targets are met but the 28% sediment target is not, it is clear that other sources, including upland sources, are contributing to the sediment loading observed.*

6. **Comment:** The sediment targets used to evaluate existing conditions may not be appropriate in many of these streams. For example, in gravel bed streams keying in on the 6.35 mm particles may cause an analyst to identify problems that don't really exist. That is, there may not be a problem, that's just what the streams are. A gravel bed stream (Rosgen B4) would naturally have a higher percentage of fine gravels (2-6.25 mm) than a boulder stream (Rosgen B2). Therefore, the same sediment target should not apply to both stream types. Until better information becomes available, we recommend using <2 mm (sand and finer) for gravel bed streams and <6.35 mm for cobble/boulder streams. Also, why are we extrapolating values from another area (in a different climatic and geologic part of Idaho) when there is a reference stream in this subbasin (Webber Creek)? The target should be based on what the physical system can provide, not just what fish want. If the extrapolated values are used, there should be a discussion on how the climate and geology of this basin differs from the area the values were obtained from. This discussion should include a conclusion regarding expected particle sizes and the amount of sediment produced in the Medicine Lodge subbasin (would it be more or less than the area the target came from?)

7. **Comment:** Is there another procedure that can be used to measure our progress towards the sediment target? McNeil sampling is more appropriate for research projects than for this type of monitoring. This technique is an expensive and time-consuming process that would result in small sample sizes. This raises the concern of sampling non-representative sites (it's hard to tell how representative a site is when the area being sampled is subsurface) and performing non-statistically significant monitoring. If research using this method is used to establish targets, all aspects of the research need to be followed to make the values meaningful. This includes sampling size and frequency. The subbasin assessment did not use a large sample size, so comparisons to most research are questionable at best. In summary, the variability of this element requires large sample sizes. Small sample sizes would make this method non-defensible. Were other methods considered, or did the TMDL go right to McNeil sampling?

8. **Comment:** If surface fines were used instead of depth fines, local reference data could be obtained from the Beaverhead-Deerlodge National Forest (BDNF). The BDNF is located just on the other side of the divide, and they have an extensive network of reference reaches. Using sites from the Beaverhead Mountains (local) would provide much better information than limited depth fines samples using extrapolated targets. Surface fines would also be a better indicator in rearing habitat (Cold Water Aquatic Life).

   Response: *The 28% or less depth fine sediment (<6.35mm) target is a benchmark used for protecting salmonid eggs deep in the riffle independent of geology and Rosgen class. It is true that some streams naturally have higher amounts of small grain size due to geology and position on the landscape. However, we believe the impacts of fine sediment over 28% reduces salmonid spawning success. In streams that are more erodable, it is more important to manage riparian areas to maintain channel geometry and reduce sediment inputs. For Example, Webber Creek, a reference stream as you say, is considered to have minimal human impact but is naturally erosive, has a 29% average of depth fines below the 6.35mm size. DEQ considers this close enough to the benchmark to be considered a background amount, which supports the sediment targets developed in this TMDL.*

   As described in Section 2.3 of the Subbasin Assessment, other sediment data was collected for the streams of concern to support the basis of the TMDL's for sediment. These include surface fines data, streambank erosion inventory, and streambank visual assessment protocol. This data collected supported DEQ's determination the sediment TMDLs for Edie Creek, Irving Creek, and Medicine Lodge Creek need development.

   Surface fines data collected within the Medicine Lodge subbasin, as summarized on page 47 of this document,was highly variable and did not show trends that could be used as part of this TMDL. In addition, surface fines have less of an effect on salmonid spawning because surface sediments can easily be swept away by the fish when they spawn. Depth fines sampling was chosen as a sediment target because sediments below the surface affect salmonid spawning and fry survival, more so than surface fines. This is not to say that surface fines data cannot be used for comparison of data obtained from the Beaverhead-Deerlodge National Forest (BDNF). Surface fines data collected in the Medicine Lodge subbasin may be used as corroborating evidence to determine if beneficial uses are being supported following implementation of this TMDL.

9. **Comment:** During previous comments, we mentioned the availability of 2001 temperature data for Fritz Creek. We also have No2+No3 and Orthophosphate data for Fritz, Irvin, Warm, Divide, and Edie Creeks from 1995. Therefore, it is incorrect to say that nutrient data does not exist for Fritz Creek. As of October 4, we will also have 2002 temperature data for Fritz and Webber Creeks.

   Response: *DEQ evaluated the most recent data collected for the evaluation on temperature and nutrients. This includes Orthophosphate and NO_2 and NO_3 data collected by the BLM in 2000 and 2000 temperature data collected on the streams of* *concern. Nutrient data collected was not included in the Subbasin Assessment since no exceedances were observed. The conclusion section of the Subbasin Assessment on page 65 was revised to more clearly state that nutrient data collected by the BLM indicates no nutrient enrichment.*

10. **Comment:** Section 4, "Summary of Past and Present pollution Control Efforts", does not include actions taken by the forest to reduce bank impacts. The main action is the construction of several enclosures along Fritz Creek.

    Response: *This information was noted in Section 4 of the Subbasin Assessment and shall be considered in the implementation phase of this TMDL.*